THE YEAR BOOK *of* GENERAL SURGERY

(*1954–1955* YEAR BOOK *Series*)

EDITED BY

EVARTS A. GRAHAM, A.B., M.D

Emeritus Professor of Surgery Washington University School of Medicine formerly Surgeon in-Chief of the Barnes Hospital and of the Children's Hospital St Louis

With a Section on

ANESTHESIA

EDITED BY

STUART C. CULLEN M.D

Professor of Surgery and Chairman of Division of Anesthesiology State University of Iowa College of Medicine and Hospitals

---

THE YEAR BOOK PUBLISHERS

INCORPORATED

200 EAST ILLINOIS STREET

CHICAGO 11

THE PRACTICAL MEDICINE YEAR BO(

This volume is one of the 13 comprising the Practical Me[illegible] of Year Books founded in 1900 by G P Head, M.D., and C J Head, and published continuously since then The complete list follows

Medicine: *Infections,* edited by PAUL B. BEESON M.D *The Chest,* by CARL MUSCHENHEIM, M.D *The Blood and Blood Forming Organs,* by WILLIAM B. CASTLE, M.D *The Heart and Blood Vessels and Kidney* by TINSLEY R. HARRISON M.D *The Digestive System* by FRANZ J INGELFINGER, M.D *Metabolism,* by PHILIP K. BONDY M.D

General Surgery edited by EVARTS A. GRAHAM, M.D., with a section on *Anesthesia,* by STUART C. CULLEN M.D

Drug Therapy edited by HARRY BECKMAN M.D

Obstetrics & Gynecology edited by J P GREENHILL, M D

Pediatrics edited by SYDNEY S GELLIS, M.D

Radiology: *Diagnosis,* edited by JOHN FLOYD HOLT M.D., and FRED JENNER HODGES, M.D *Radiotherapeutics* by HAROLD W JACOX, M.D., and MORTON M. KLIGERMAN M.D

Eye, Ear, Nose & Throat: *The Eye,* edited by DERRICK VAIL, M.D *The Ear Nose & Throat,* by JOHN R. LINDSAY M.D

Neurology Psychiatry & Neurosurgery: *Neurology* edited by ROLAND P MACKAY M.D *Psychiatry* by S. BERNARD WORTIS, M.D *Neurosurgery* by PERCIVAL BAILEY M.D., and OSCAR SUGAR, M.D

Dermatology & Syphilology edited by MARION B. SULZBERGER, M.D., and RUDOLF L. BAER, M.D

Urology edited by WILLIAM W SCOTT M.D

Orthopedics and Traumatic Surgery edited by EDWARD L. COMPERE, M.D

Endocrinology edited by GILBERT S GORDAN M.D

Pathology and Clinical Pathology edited by WILLIAM B. WARTMAN M.D

Dentistry: *Oral Pathology & Oral Medicine,* edited by HAMILTON B G ROBINSON D.D.S. *Operative Dentistry* by DONALD A. KEYS D.D.S. *Oral Surgery* by CARL W WALDRON M.D., D.D.S. *Prosthetics,* by STANLEY D TYLMAN D.D.S., M.S. *Orthodontics,* by HAROLD J NOYES, D D.S. *Public Health,* by JOHN W KNUTSON

TABLE OF CONTENTS

PUBLISHER'S NOTE The designation (Series 1954-1955) used on the cover and title page of this volume is to indicate its publication during the "series year" which begins September 1954 with the publication of the YEAR BOOK OF MEDICINE and ends in May 1955 with the YEAR BOOK OF PATHOLOGY AND CLINICAL PATHOLOGY

The articles abstracted herein are taken from journals received between June 1953 and April 1954.

ANESTHESIA

INTRODUCTION

On a trip this year to Great Britain and France I was asked by many surgeons, especially the younger ones, "Why don't American writers make more reference to the literature of other countries?" They would elaborate on this question by complaining that the articles in American journals for the most part have bibliographies of only work that has been done in the United States This criticism of American journals was reminiscent of similar criticism raised by Americans against the German writers before World War I.

German science became supreme in the last century and therefore there seemed to be little reason why authors of scientific articles, including those on the practice of medicine and surgery, should bother about what was being done in other countries During the period of that supremacy, not only the German writers but the Americans as well often had bibliographies to their articles which contained practically nothing but references to German publications. It was considered to be a mark of erudition and of great scholarship to quote the Austrian and German literature, and some American authors adopted a snobbish attitude toward their own colleagues To qualify as a really "high hat" one would quote two or three paragraphs in the original language from a German article

Of course now that tendency, at least regarding German literature, has vanished We ought not to bring it back by merely substituting American literature for the former German writings One of the main reasons for the existence of the YEAR BOOK OF SURGERY is to give the reader a review of the world's surgical literature Obviously the selection is difficult and probably many good articles escape inclusion in this volume Nevertheless, a sincere effort is made, regardless of the language, to review the surgical literature of all those countries whose journals are obtainable

The fact that we Americans escaped the devastation created in Europe by World Wars I and II and that there was comparatively little interruption of the work of our uni

versities gave us an advantage in being able to continue scientific investigation. The inevitable result is that, at least for the time being, more contributions of value to the world's surgical literature are being made by Americans than by the surgeons of any other country The majority of the abstracts in this volume, therefore, are of American articles This, however, does not justify a spirit of complacency on our part that we have achieved permanent supremacy in our surgical advances We should take care to avoid the attitude of the Germans and of their admirers prior to World War I. Perhaps some day even the Western European civilization of which we are a part will be superseded by another Could it be Asiatic?

—EVARTS A. GRAHAM.

Preoperative and Postoperative Care in Elderly People E. Lee Strohl[1] (Univ of Illinois) believes the common axiom, "he is too old for an operation," is often an excuse for avoiding surgery The number of elderly people is increasing and will approach 23,000,000 in 1970 The criteria for surgery in the elderly patient should be (1) is the surgery essential to save life, (2) will operation remove physical disability and rehabilitate the patient, and (3) will it cure a malignant disease? Tissue healing occurs equally well at all ages Chronological age does not necessarily parallel physiologic age There are more complications in the old patient, and his life expectancy should be considered and discussed with him and his relatives

Special psychologic preparation is necessary Because of the frequency of heart disease as a cause of death, the cardiovascular system should be carefully evaluated. Clinical evaluation of cardiac reserve, chest x ray and electrocardiogram are important. Knee length elastic stockings worn for three to four weeks help prevent thromboembolic phenomena.

Care of the respiratory tree is especially important as respiratory exchange is diminished and low grade infection is present in most patients Care should be taken to avoid silent aspiration of gastric contents There is a tendency to dehydration and lowered blood volume Defects should be corrected before surgery if possible Most older patients have impaired renal function from arteriosclerosis or chronic glomerulonephritis. The concentration-diuresis test with the nonprotein nitrogen determination usually give satisfactory information of functional capacity Mechanical obstructions should be anticipated and corrected if possible Liver function should be assessed Estrogens, androgens, corticotropin and cortisone have a role in the management of the older patients.

Regional block with procaine supplemented by gas is pre-

(1) Chicago M. Soc. Bull. 56 59-64 July 25 1953

ferred for anesthesia. Good nursing, care of the respiratory tract and early ambulation are essential An adequate con centration of oxygen must be provided Replacement of fluid and electrolytes should be carefully carried out Over distention of the bladder is avoided, a small bag type in dwelling catheter is preferable to repeated catheterization. Small doses of sedatives and analgesics will give the patient more comfort with less depression and will decrease post operative complications.

With careful observation and a vigilant search for in cipient changes, most irreversible changes may be prevented before they occur

[In the case of malignant disease one may ask, "Will a palliative opera tion really palliate or may it make the patient very uncomfortable?"—Ed.]

Postoperative Mortality in the Aged. Max S Sadove, Myron J Levin and Richard A Jones[2] (V.A Hosp., Hines, Ill) review the causes of postoperative death in 60 of 934 patients over age 60 operated on in 1951 Death was unrelated to surgery in 28, making a corrected mortality of 3 4% There were 2.24% operative deaths

Neoplastic disease accounted for 16 of the 28 deaths and vascular diseases for 5 Urologic procedures, major laparotomy and thoracotomy accounted for most of the postopera tive deaths Peritonitis was the most frequent cause of death related to operation, with vascular accidents, hemor rhage and septicemia close behind

Most deaths related to surgery occurred within 14 days, whereas deaths unrelated to surgery were fairly evenly distributed throughout the postoperative period

Spastic and Hypertrophic Sphincter Mechanisms Accord ing to Lewis E Schottenfeld[3] (Brooklyn), a number of sphincter or sphincter like mechanisms in the body have the primary function of exercising some regulatory control over the passage of secretions, excretions and food from one hollow viscus to another Disturbances of control by the autonomic nervous system, as reflected by the degeneration or absence of ganglions in Auerbach's myenteric plexus, give rise to phenomena of obstructed function Some com mon denominator may affect all or most of these sphincters

(2) J Am. Geriat. Soc 2 120-124 February 1954
(3) Am. J Surg 86 659-664 December 1953

Spasm or hypertrophy can occur in the sphincter of Oddi or the pylorus. Other sphincters or sphincter like mechanisms are the cardioesophageal, associated with cardiospasm and megaesophagus, the rectosigmoid junction, associated with megacolon or Hirschsprung's disease, and the ureterovesical, hypertrophy of which produces megaureter If the resultant syndromes fail to respond to medical treatment, direct surgery on these mechanisms is often necessary for relief

Cessation of Circulation in General Hypothermia I. Physiologic Changes and Their Control. General hypothermia has been used in dogs and human beings to obtain a dry heart for intracardiac surgery In experimental studies the mortality rate from ventricular fibrillation and shock has been very high Henry Swan, Irvin Zeavin, Joseph H. Holmes and Vernon Montgomery[4] (Univ of Colorado) report observations on over 100 dogs and 3 human subjects undergoing general hypothermia with and without circulatory arrest Data were obtained on the pH, serum sodium, chloride, potassium and phosphorus levels, plasma protein and hematocrit levels, total body water extracellular fluid space and blood volume changes and urinary output in an effort to determine the cause of ventricular fibrillation

Dogs were cooled in ice water to temperatures between 20 and 25 C No cardiocirculatory drugs were used The hypothermic dogs undergoing circulatory arrest by occlusion of cardiac inflow for 15 minutes were routinely subjected to auricular cardiotomy during this period The serum sodium levels remained constant, serum chlorides showed a consistent slight rise during the experiment Blood volume tended to decrease but the change was not excessive and was proportional to a moderate over all loss of body water

Aberrations of blood pH and potassium both appear to be important in ventricular fibrillation, which may be initiated by sudden rises in blood pH from abnormally low levels Adequate spontaneous respirations cease in hypothermia, so artificial respiration must be used, with attention to rate and depth. Fibrillation may be avoided by

(4) Ann. Surg 138 360 376 September 1953

vigorous hyperventilation throughout the cooling period. A consistent fall in serum potassium values occurred during cooling There is a shift of this ion from the extracellular fluid space during cooling, possibly into body cells Although the significance of this change is not clearly understood, *use of a potassium solution as an agent to defibrillate* the cold heart has proved successful, whereas other methods have not. There appears to be a correlation between CO_2 content (blood pH) and serum potassium levels This same relation was seen in the three patients, all of whom recovered from surgery

There are three periods during hypothermia when animals are prone to go into ventricular fibrillation (1) during cooling below 26 C without cardiac manipulation or circulatory arrest when the stimulus is unknown, (2) during cardiac manipulation or circulatory arrest when the stimulus is mechanical trauma, and (3) immediately following restoration of circulation after occlusion, when the stimulus may be a rapid change in tissue pH.

In the human being a temperature of 25 C and inflow occlusion for periods exceeding 10 minutes should be approached with caution Repeated occlusion with a rest interval between might prove safer

Effect of Efocaine in Control of Postoperative Pain Roland F Marks[5] (Walnut Creek, Calif) reports 14 cases in which efocaine was used to relieve postoperative tonsillectomy pain. *Primary infiltration was done* in all cases, general and local, with 6 cc. of 2% xylocaine* with epinephrine 1 50,000 After dissection of the tonsil and control of hemorrhage, 1 cc efocaine was injected at the base of the tongue and attachment of the anterior and posterior pillars.

In one case, injection of 4 cc bilaterally immediately produced severe edema of the soft palate which obstructed the postnasal space but did not extend into the hypopharynx. The edema subsided in four hours after 30 mg benadryl* was injected intravenously

All patients experienced great relief from postoperative pain. *Moderate to severe hemorrhage occurred in six* between the 6th and the 24th day A pale slough, 1 cm. in

(5) Laryngoscope 63 861 862 September 1953

diameter, was noted at the base of the tongue at the site of injection in almost all cases on the 7th day

Despite the relief from pain, edema, delayed healing and postoperative hemorrhage make use of efocaine after tonsillectomy unjustifiable.

[So many bad complications after the use of this substance have been reported that it should not be used.—Ed.]

Some Observations on Tetanus, based on 58 cases with a mortality of 31%, are reported by Frank Beare[6] (Adelaide) Clostridium tetani occurs in spore form in soil and in the intestinal tract of many animals and of man. It is anaerobic and thrives in closed dirty wounds. The probable sites of infection in the author's cases were punctured wounds of the limbs (17 cases), cuts in limbs (11), limb burns (4), chronic ulcers (5), contusions (5), abrasions (5), discharging ear (1) and surgical wounds (8) The site was unknown in two More males than females were affected, and all ages were represented. Early signs of tetanus were trismus with sweating, dysphagia and rigid abdominal muscles. Except in certain fulminating cases, tetanic convulsions as distinct from constantly present tightened muscles were not an early feature Convulsions never occurred in 18 patients Ten males had retention of urine, and four patients had diplopia

Carefully planned treatment is most necessary, and skilled nursing is a potent factor in recovery The patient should be kept in a quiet, darkened room and not disturbed needlessly Fluids should be given by mouth or parenterally to combat dehydration. *Tetanus antitoxin should be given as* soon as possible in a dose sufficient for the whole course of the disease and need not be repeated unless necessary As a basic dose, 100,000 I.U is given intramuscularly and the same dose intravenously All patients should be tested for sensitivity After the antitoxin has been given, the wound should be debrided and opened and any foreign bodies removed. The site of operation can be blocked off with 40 000 I.U of tetanus antitoxin. Penicillin is routinely administered. Barbiturates, orally and intravenously, may be necessary for sedation. A muscle relaxant, mephenesin, was used

(6) M. J Australia 2 949-954 Dec. 26 1953

in 11 cases, but results were variable Tracheotomy was performed in nine.

Early passive immunization with tetanus antiserum is most important as prophylaxis after possible tetanus infection. None of eight patients so treated died. For an ordinary wound, 1,000 I U should suffice, but for a severe wound at least 1,500 I U should be given If more than 48 hours has elapsed since a severe wound was inflicted, 3,000 I U is indicated To maintain a high degree of protection after a severe wound, a further dose of 1,500 I.U can be given 10 days after the initial dose, and a third dose 10 days later if necessary If surgery is to be done, 1,500 I U should be given the day before

Active immunization with tetanus toxoid has practically eliminated tetanus in the armed forces If there is documentary proof of previous immunization, a further dose of 1 cc tetanus toxoid is all that is needed after an injury

The duration of the incubation period is not a reliable prognostic guide The period of development, i.e., the time interval between onset of the first muscle stiffness, usually trismus and the first phasic spasm is significant When this period is short, less than 24 hours, death almost invariably occurs Absence of tetanic spasms is the most favorable prognostic sign Of 40 patients with spasms, 16 died, whereas of 18 without spasms, only 2 died.

Effect of Surgery on Dogs Following Whole Body X irradiation. Gordon E. Gustafson and Frank A. Cebul[7] (Western Reserve Univ), in an experiment designed to determine whether surgical trauma superimposed on whole body x irradiation greatly altered mortality, used 10 pairs of dogs exposed to 200 r and 8 pairs exposed to 300 r Surgery was performed 20 hours after irradiation on one dog of each pair A segment of ileum was removed under sodium pentobarbital anesthesia The operation was well tolerated by all dogs Mortality was 39% with irradiation alone and 44% with irradiation and surgery On the first postoperative day the white blood cell count was increased 41% above the mean preirradiation count in the nonsurgical dogs, the white count during the same period was decreased 37% Survival time, red blood cell counts hemoglobin concentra

( ) Surg., Gynec. & Obst. 98 49 54 January 1954

tion, body weight and total serum proteins were similar in both surgical and nonsurgical groups The wounds healed remarkably well Skin closure was done on 13 dogs with subcuticular sutures, no infection occurred The common est pathologic process in dogs dying after irradiation was a profound bacterial pneumonitis

Optimal Ages for Elective Surgery in Infants and Children. Colin C Ferguson[8] (Univ of Manitoba) reviews the operative procedures and optimal age for surgery for the more common congenital lesions of infants and children

OPTIMAL AGES FOR ELECTIVE SURGICAL PROCEDURES ON INFANTS AND CHILDREN

Lesion	Procedure	Optimal Age
Harelip	Cheiloplasty	4-6 wk.
Cleft palate	Palatoplasty	18-24 mo
Dermoid cyst	Excision	Any age preferably after 6 mo.
Lop ears	Plastic correction	5-6 yr
Supernum. ear tabs	Excision	Any age
Preauricular sinus	Excision	After 1 yr
Branchial cyst and sinus	Excision	After 1 yr
Thyroglossal cyst and sinus	Excision	After 1 yr
Cystic hygroma	Excision	Soon as noted
Patent ductus	Division	3-8 yr
Tetralogy of Fallot	Pulmonary aortic anastomosis	3-10 yr
Coarctation	Excision and aortic anastomosis	After 9 yr
Umbilical hernia	Herniorrhaphy	After 1 yr
Inguinal hernia	Herniorrhaphy	Any age
ydrocele	Excision	After 1 yr
ndescended testis	Orchidopexy	9-10 yr
ypospadias	Correction of chordee	3-4 yr
	Construction of urethra	10-12 yr
strophy of bladder	Bilat. uretero-sigmoidostomy	2-4 yr
	Excision of bladder	4-5 yr
bbed fingers	Plastic repair	3-5 yr
ernum. digits	Excision	After 2 yr
emangiomas	Roentgen therapy	Any age
Pigmented nevi	Excision	2-6 yr

(table) Many of these procedures are technically difficult and of great magnitude and should be attempted only by trained surgeons in hospitals with anesthetists surgical staff and nurses who are experienced in the surgical care of infants and children

(8) Canad. M. A. J 69 381 380 October 1953

Further Investigations on Getting Patients up from Bed Early and on Dicumarol® Treatment as a Prophylactic for Postoperative Thrombosis Stig Borgström[9] (Univ of Lund) studied the incidence of thromboembolism in patients aged 25 and up who were operated on in 1950 and 1951—2,351 and 2,109 patients Early ambulation has been practiced on these patients and prophylactic dicumarol® was given postoperatively to those aged 40 and older This group was compared with a similar series for 1947 and 1949 (2,051 patients) in which both the principle of early ambulation and the prophylactic administration of dicumarol® postoperatively to patients 25 or over were applied The incidence of thromboembolism was the same in all three groups—1.5% among those seen in 1947 and 1949, 1 5% among those seen in 1950 and 1.4% among those seen in 1951. Despite the omission of prophylactic dicumarol® postoperatively in the 25-39 age group during 1950 and 1951, the incidence of thromboembolism during both years was uninfluenced.

An earlier report indicated that the incidence of thromboembolism among patients aged 45 or older has shrunk by about 75% as compared to groups not given prophylactic dicumarol® *and not got up from bed early* It is concluded that, in general, prophylactic dicumarol® postoperatively is not necessary in the 25-39 age group, if these patients are made to get out of bed soon after operation.

Hyaluronidase as an Aid in Surgical Dissection. According to Milton A. Streuter[1] (Brawley, Calif.), hyaluronidase, an enzyme that acts on the hyaluronic acid, the intercellular cement substance, can be useful in surgical dissection It may facilitate considerably the separation of closely adherent vital structures Hyaluronidase solutions which contain 800 viscosity units (240 turbidity reducing units) per cc have been applied topically to various tissues of dogs with dissection sponges during surgery with no apparent *deleterious effects.* The *hyaluronidase solution* was helpful in separating adherent loops of bowel, the portal triad, the inferior vena cava from the portal vein, the pleura from the lung hilus and the various structures of the neck

(9) Acta chir scandinav 104 426-434 1953
(1) Surgery 34 28-32 July 1953

The hyaluronidase solution was used clinically in 27 operations of various types and proved most useful when accurate anatomic demonstration was difficult because of close adherence to adjacent vital structures Dissection in the portal triad, lung hilus or behind the thyroid gland is fraught with considerable danger in the presence of residual fibrosis The enzyme solution helped in these operations considerably The enzyme has no appreciable effect on intact pleural or peritoneal surfaces

Contraindications to its use are active infection or malignant disease in the operative area

[I have had no experience with this method, but it is an interesting suggestion which should be tried.—Ed.]

Porphyria in Surgery Exact surgical diagnosis often depends on knowledge of medical conditions that simulate surgical disease Among these is acute intermittent porphyria, which is more common than generally realized A. J Kergin[2] (New Westminster, B C) reports three cases seen in surgical wards in one year Porphyria is an inborn error of blood pigment metabolism manifested in three clinical forms (1) The light sensitive or congenital type is predominant in males and inherited as a mendelian recessive It appears early and is often associated with hemolytic jaundice Its main feature is extreme light sensitivity (2) Acute intermittent porphyria, a mendelian dominant appearing in the third or fourth decade, is predominant in females (3) A mixed form In porphyria there is some interruption in the cycle of hemoglobin synthesis or breakdown, with accumulation and excretion in the urine of abnormal porphyrins

Abdominal symptoms of porphyria may be due to the effect of porphyrins on either the smooth muscle or the autonomic nerve supply of bowel, and neurologic symptoms to their direct effect on nerve cells and cardiovascular symptoms to vasospasm Acute episodes are only occurrences in a chronic disease with a number of exciting factors. Porphyria may mimic any intra abdominal condition, cause paroxysmal hypertension, simulate hyperthyroidism, initiate itself with a peripheral neuritis or myelitis, be ac

(2) Canad. M. A. J 69 146-148 August, 1953

companied by a neuropsychiatric upset or by skin pigmentation

Diagnosis may be made by observing acidified urine placed in sunlight The color changes from yellow to a shade that varies from pink to port wine Diagnosis may also be based on the Watson Schwartz test.

CASE 1—Man, 49, seen on nine occasions, always complained of sharp steady abdominal pain with vomiting associated with alcohol consumption He had had acute attacks for 20 years. The pain was sometimes epigastric and sometimes most severe in the left lower quadrant There was history of extreme emotional imbalance, and a coarse tremor was noted without demonstrable neurologic lesion. The only finding on barium enemas was general marked hypertonicity During the last hospitalizations, the urine was dark and positive for porphobilinogen, and liver function was impaired. He died 6 weeks later Autopsy revealed portal cirrhosis with massive ascites.

CASE 3—Woman, 44, was hospitalized with excruciating lower abdominal pain, with no specific tenderness. History disclosed major operations, marital difficulties and drinking bouts related to abdominal pain She had dark icteroid pigmentation above the collar bone and on the backs of the hands with minimal exposure to the sun Because of no evidence of organic disease, the urine was tested and found to be strongly positive for porphobilinogen She became wildly manic with hallucinations from which she recovered slowly She was later hospitalized twice for psychic episodes. When last heard of, she was in a mental hospital

[Every doctor should be aware of the confusion caused by porphyria in the diagnosis of acute abdominal surgical conditions.—Ed.]

TECHNICAL CONTRIBUTIONS

Instrument for Continuous Recording of Body Temperature Robert M Weiss and Charles B Ripstein[5] (New York Univ) have devised a highly accurate thermometer for use in cardiac surgery under artificial hypothermia or in treatment of hyperpyrexia It is simple to operate and interpret, provides a continuous record and is rugged and portable It is an adaptation of a standard industrial, liquid actuated, clock motor-driven, recording thermometer The sensing unit is a specially designed stainless steel,

(5) J.A.M.A. 152 610 June 13 1953

narrow stemmed bulb which can be inserted into the rectum without discomfort to the patient This is connected to the recording thermometer by 6 ft of plastic covered stainless steel capillary tubing Self contained batteries supply power for electric contacts set at 103 and at 80 F so that warning lights switch on automatically at these temperatures The chart used has a scale range of 70-110 F, marked off in 0 5° divisions which can be read to within 0.25°, and gives a continuous 12 hour record with 10 minute and hourly divisions The unit requires no attention

Simplified Method for Removal of Skin Sutures William Mendelsohn[3] (Yale Univ) avoids the necessity of elevating

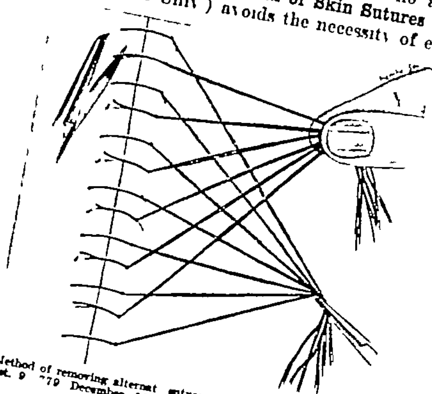


Fig. 1 —Method of removing alternate sutures. (Courtesy of Mendelsohn W Surg., Gynec. & Obst. 97 779 December 1953)

each suture individually to be snipped with scissors by leaving the individual sutures long and tying them together in bundles If it is planned to remove alternate sutures the ends are tied in two groups Individual sutures are then snipped in the usual manner and one quick pull on the bundle removes all sutures at once (Fig 1) Children tolerate such a procedure well.

(3) Surg Gynec. & Obst. 97 779 December 1953

Suction Apparatus for Abdominal Fistulas Selwyn Taylor[4] (King's College Hosp, London) describes an apparatus (Fig 2) originally devised for managing a small bowel fistula opening on the abdominal wall and since used for biliary and pancreatic fistulas Small bowel contents rapidly excoriate the skin and continuous suction applied through a tube placed in the fistula may delay closure

The hole in the base of the cup is centered over the fistula. Its special rim insures water tight closure, and tulle gras

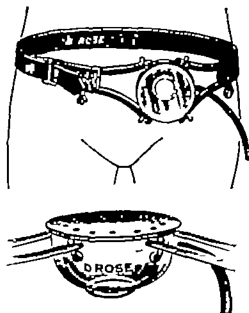


Fig 2—Suction apparatus for abdominal fistulas. (Courtesy of Taylor S.: Lancet 1 1131 June 6 1953)

can be used to protect the skin within the bottom of the cup The contents are continuously withdrawn through the side tube connected to an electric sucker The lid is perforated so that no negative pressure can be built up The apparatus reduces waste of dressings, and the patient, dry and comfortable, can sleep undisturbed by frequent changes of dressings

Use of Polyethylene Tubing in Intravenous Therapy for Surgical Patients Paul Erwin, J H. Strickler and Carl O Rice[5] (Minneapolis) have noted several unpleasant sequelae after the prolonged use of an intravenous needle and have therefore evaluated the use of polyethylene tubing in such

(4) Lancet 1 1131 June 6 1953
(5) A.M.A. Arch. Surg 66 673-678 May 1953

prolonged intravenous therapy The tubing was used in the catheterization of 366 veins in 349 patients of all ages and was inserted after a variety of surgical procedures Needles and tubing of two different sizes were used For routine administration of parenteral fluid, the authors used a thin walled 18 gauge BD needle, through which 24 in Clay Adams polyethylene tubing was passed This tubing has an inside diameter of 0 034 in and an outside diameter of 0 050 in For infusion of whole blood, they used a 13 gauge thin walled BD needle with a 24 in length of Clay Adams polyethylene tubing with an inner diameter of 0 047 and an outer diameter of 0 067 in. The needles were autoclaved, and the tubing was cold sterilized for 18 hours or more in 1 1,000 aqueous benzalkonium (zephiran*) chloride solu tion The vena basilica just above the medial epicondyle is the preferred vessel The needle is inserted into the vein during surgery or under local anesthesia and the polyethyl ene tubing is then inserted into the vein for a distance of 15 in or more.

The polyethylene tubing was left in the vein for 1-42 days Of the 366 veins catheterized, only 98 showed local reactions Inflammatory reactions were found in 16 66% and mechani cal irritation developed in 10 10% No embolic phenomena nor slough or abscess were noted Although inflammatory reactions were undesirable, none was considered alarming In cases in which inflammatory reaction developed, the tube remained in the vein for an average 3 9 days and in cases with mechanical irritation the polyethylene tube had re- mained in place for an average 3 1 days in cases with no reaction, the catheter had been in for an average 2 73 days. These findings would suggest that prolongation of continu ous catheterization contributes to the incidence of local in flammatory reaction in the vein. In a few cases in which the tubing had to remain in place for a week or longer, the addition of 10 mg heparin to each liter of intravenous fluid permitted use of the tubing for an average 8.5 days

A culture of Staphylococcus aureus was found in every instance of inflammatory reaction, but never in cases with no inflammatory reaction. Although the tubing was always introduced under sterile conditions this would indicate that

there was some break in the sterility in these cases. The type of solution used did not significantly alter the local venous reaction Measurement of inserted tubing showed that the longer tubing permitted more prolonged catheterization before inflammatory reaction developed than did the shorter tubing A small red spot at the site of puncture, pain, soreness, induration, swelling and redness, in that sequence, within a 24 hour period are the progressive signs indicating the need for removal of the tubing At the first such evidence of venous reaction, the polyethylene tube should be removed It may be reinserted in the contralateral arm if more parenteral fluid is needed By this means, the development of definite thrombophlebitis may often be averted

Silicones in Plastic Surgery Laboratory and Clinical Investigations, Preliminary Report James Barrett Brown and Minot P Fryer with Peter Randall and Milton Lu[7] (Washington Univ) state that silicone preparations can be used to waterproof the skin and thus prevent maceration of skin adjacent to wet dressings, to protect areas of drainage around the mouth, genital and rectal areas, to protect skin flaps in exstrophies, hypospadias and perirectal surgery, and to waterproof dressings in areas where gauze and waste are used for fixation of skin grafts Silicone preparations cannot be used in areas which are inflamed nor can they be maintained for long periods when general cleaning and grooming of the skin secretions are necessary Silicone is useful on donor sites of split grafts because it allows easy removal of fine mesh gauze and free drainage and gauze incorporated with it can be resterilized without loss of stability There are no sensitivities to it and it has no odor or taste Silicone does not interfere with wound healing and when implanted subcutaneously it is dispersed

Silicone preparations may be used in the future as permanent subcutaneous prostheses Silicone preparations are made of organic material which gives it stability and of hydrocarbons which give it flexibility Silicones are resistant to temperature extremes (—100 to +500 F), do not stick to surrounding materials, are antifoaming do not re

(7) Plast. & Reconstruct. Surg. 12 374 376 November 1953

act with most chemicals, burn slowly and are resistant to sunlight and weather

In medicine silicone is available as stop-cock grease, as paste with part petrolatum as creams and as surgical oil under different names such as silicote, surgicote oil, pro-derma cream, covicone* and others

---

SHOCK, FLUIDS AND ELECTROLYTES

Artificial Hibernation in Severe Shock as practiced in the Indo-China campaign and its application to civilian trauma are discussed by H Laborit and P Huguenard[8] (Paris) Before being transported to the hospital the patient is given an ampule of phenergan*-dolosal and 4560 R P (a phenothiazine derivative) At the hospital the patient is given standard treatment divided into three periods, only the first of which differs from classic hibernation.

To patients with blast injury or low arterial pressure a rapid, massive transfusion is given by catheter into the humeral artery To others, fresh matched blood is given intravenously preferably under pressure, with various drugs Oxygen therapy, gastric aspiration androgens and neostigmine intramuscularly are given during the first part of shock therapy which lasts 30-90 minutes

Surgery is carried out under local, regional or refrigeration anesthesia in the period of stabilization, which lasts 12 24 hours and is characterized by hypothermia, hypometabolism bradypnea, hypotension and relative bradycardia

The period of recovery from hibernation is 12-40 hours. Androgens, neostigmine and heparin are given intramuscularly addition of an adrenolytic agent like hydergine or regitine* is almost indispensable

Progressive neuroplegia with transfusion, applicable in military and civilian practice alike, diminishes transportation shock, increases comfort extends the time for surgical procedures and permits execution of several procedures at the same operative session.

---

(8) Presse méd. 61 1029 1030 July 18 1953

Hazards of Blood Transfusions. Charles E Rath[9] (Georgetown Univ) believes that, with the increased use of blood transfusions, the handling has passed from physicians to technicians. As a result, physicians have become less aware of the hazards and tend to use transfusions when not definitely indicated.

Clerical and technical errors are frequently made Extreme care must be used in handling blood, and cross-matching should be performed with potent serums in serum mediums. All doubtful cross matches and cross-matches of patients who have had previous transfusions should be checked with Coombs serum

General reactions include pyrogenic reactions (in 3-6% of all transfusions), allergy, circulatory overload, particularly in elderly patients and in individuals with congestive heart failure, air embolism, and potassium toxicity in patients who have increased plasma potassium levels and who are given blood stored 14 days or longer

Infections may be transmitted by bacterial contamination due to faulty technic. Homologous serum hepatitis is a potential hazard and it is doubtful if any of the methods of killing the virus in plasma are sufficiently effective to afford protection Transmission of malaria and syphilis is possible, though it has not been a serious problem in the United States.

Hemolytic transfusion reactions are in nearly every instance due to incompatible blood but may result from old or poorly prepared blood Symptoms include restlessness, anxiety flushing of the face, precordial oppression and pain, pain in the back and thighs, chill, fever and, in severe cases, cyanosis and shock. Frequently a hemorrhagic tendency develops after the reaction. During surgery under anesthesia, bleeding from the operative site may be the only clue to a hemolytic reaction. Intravascular hemolysis of significant degree always produces a pink color in the plasma or serum which is easily detected with the naked eye

When a hemolytic reaction is noted the transfusion should be stopped and the blood rechecked with a fresh sample supportive measures should be started to maintain the blood

(9) G P 7 67 74 June 1953

pressure and prevent shock. Dehydration should be prevented. If total anuria persists, an artificial kidney should be used.

It is highly desirable to avoid type O blood except for O recipients, as there are many instances of fatal hemolytic reactions in recipients of other types, especially type A patients. Isosensitization, which means sensitization to a normally occurring blood group as a result of transfusion, usually will be detected if the cross match is performed in serum medium and checked with Coombs serum. There is danger of erythroblastosis fetalis resulting from sensitization of an Rh negative woman with Rh positive cells. Progressive tissue iron deposition occurs in patients with chronic anemia who receive multiple blood transfusions over a period of years.

Blood, Plasma, Serum and Urine Changes Following Hyperoncotic and Iso-oncotic Dextran. Lawrence Greenman, Emily B. Fergus, F. M. Mateer, F. A. Weigand and T. S. Danowski[1] (Univ. of Pittsburgh) administered 12% sodium free dextran intravenously to eight patients, five of whom were edematous, four in the nephrotic stage of glomerulonephritis. In five other studies 6% dextran in normal saline was administered. Those with edema before the study received diets limited to 2 mEq. sodium and containing about 150 mEq. potassium per day.

Infusion of 500-1,000 ml. of 12% dextran was followed by decrease in hemoglobin and hematocrit values, with subsequent return to normal. In nonedematous subjects, plasma volume increased 34-67%; in edematous patients, it expanded to a greater degree, reaching +82 and +187% in two cases. Plasma volume began to fall 3 hours after infusion but remained above pretreatment levels 20-24 hours. Serum protein levels decreased as would be expected from plasma increase. Chloride and bicarbonate values remained constant. Diuresis occurred, usually with no significant change in amounts of solute excreted during the dextran induced diuresis. Diuresis ceased as pretreatment body weight was reached in nonedematous subjects; in edematous patients diuresis usually continued long enough to

(1) J. Appl. Physiol. 6:79-92, August, 1953.

result in negative water balance Infusions were tolerated without complaint or obvious reaction. Slight increase in systolic and diastolic blood pressure was noted

With 6% dextran in saline, hematocrit and hemoglobin values also fell and plasma volume expanded, though the changes were less pronounced than with 72% dextran. Except for elevation of sodium and chloride levels the serum constituents followed a similar pattern. Urinary response was less constant and less pronounced with 6% than with 12% dextran

In the period following infusion, plasma change is often in excess of actual infusion when the 12% preparation is used, which is in keeping with the hyperoncotic properties of this concentration and indicates transfer of interstitial fluid into the circulation. Expansion of plasma volume persists for intervals in excess of those obtainable with solutions of glucose or saline containing no colloid and is similar to those after human albumin is given.

These properties of dextran might be beneficial in clinical conditions other than acute cardiovascular collapse, especially in reducing the edema associated with hypoproteinemia.

"Reactions" to Dextran Previous investigators have noted a rarity of all types of reactions when dextran is infused into patients with low blood volumes due to blood loss and a relative frequency when the recipient's blood volume was normal A W Wilkinson and I. D E. Storey[2] (Univ of Edinburgh) infused 500-1,000 ml of 6% dextran in 0.9% saline into five healthy males, aged 21-38

Reaction of various degrees developed in all five, including whealing, redness and itching of the skin, fulness of the head, flushing, retrosternal pain, nausea and a sensation of illness and fulness of the chest lasting up to two hours. After infusion changes in posture were followed by vasomotor disturbances. On standing at five hours, three of the five were euphoric and felt "ill" with pounding and fulness of the head and chest There was a decreased tolerance to exercise and breathlessness persisted for a week or more after exertion The blood pressure and pulse were altered

(2) Lancet 2 956-958 Nov 7 1953

little during recumbency, but on sitting at one hour the blood pressure fell and the pulse rose

At 18 hours 8-10% of the dextran infused appeared in the urine and 8-11% was excreted by 48 hours, after which too little appeared in the urine to be measured accurately Initial reduction of total serum protein was about equal to the initial increase in serum dextran level. Although within four days in three volunteers the levels of both total protein and albumin rose above initial values, the packed cell volume was below the initial value after eight days Immediately after infusion there was an increase of plasma volume from 300 to 1,300 ml, diminishing in 2½ hours to less than that before infusion By 24 hours the plasma volume had risen again well above the initial volume and remained so at 48 and 96 hours

The rapid initial increase in plasma volume, dilution of plasma proteins and decrease in packed cell volume induced by these infusions were followed by the rapid movement out of the vessels of up to 30% of the total circulating plasma protein and infused dextran. Vasomotor instability seems related to rapid reduction in circulating plasma

Dextran, Oxypolygelatin and Modified Fluid Gelatin as Replacement Fluids in Experimental Hemorrhage William M Parkins, Joseph H Perlmutt and Harry M Vars[3] (Univ of Pennsylvania) present experience in dogs subjected to hemorrhagic shock.

PROCEDURES —Two degrees of hemorrhagic shock were investigated. In procedure I, healthy mongrel dogs were anesthetized with pentobarbital sodium and bled from the left femoral artery at the rate of 4 cc./kg /minute to a mean blood pressure end point of 20 mm. Hg Immediately, test solution was infused at the same rate in an amount equal to the blood withdrawn. Three hours after infusion a second bleeding volume and 24 hours later a third were obtained by bleeding the animals at the same rate to the same end point. After the three hour hemorrhage the blood removed during the second hemorrhage was reinfused. Bleeding volumes, expressed as the ratio of the second and third to the initial, are termed bleeding volume index (BVI) In procedure II, the end point of 30 mm. Hg was maintained for one hour at 30-35 mm Hg by withdrawing or injecting blood as required. Fluids were infused at the end of the hour of hypotension, and the first infusion was administered at

(3) Am. J Physiol. 173 403-410 June 1953

the rate of 2 cc./kg./minute. Hematocrits were calculated as percentage of the values at the end of the period of hypotension.

For 29 dogs in procedure I, average bleeding volume to the end point of 20 mm. Hg was 47.8 cc./kg. For 24 in procedure II, average initial bleeding volume was 42.9 cc./kg. to attain the end point of 30 mm. Hg; an additional 10.1 cc./kg. was required to maintain the blood pressure at 30-35 mm. Hg for one hour.

When compared with the initial bleeding volume, subsequent bleeding volumes after infusion of the test solution are considered a measure of efficacy of infused fluid in maintaining an effective volume and in enabling the cardiovascular system to compensate for further blood loss through its homeostatic mechanisms. The BVI is an attempt to ascribe a quantitative measure of effectiveness for the various infusion fluids. The highest average BVI resulted from use of heparinized blood, the lowest from use of saline in both procedures. Average BVI's for dextran, oxypolygelatin (OPG) and modified fluid gelatin (MFG) after procedure I were somewhat lower than for blood; those for dextran and MFG approached the value for human serum albumin. After procedure II, however, MFG produced a higher average BVI than either dextran or OPG—somewhat higher than the figure for serum albumin.

Results from procedure I showed no significant differences in the three colloids as to their efficacy in treatment of mild shock. In procedure II, the animals treated with heparinized blood or MFG all lived, whereas among those receiving the other substances several deaths occurred.

Serum Iron and Operative Stress. The normal concentration of serum iron varies from 60 to 200 μg./100 ml. The average adult serum iron concentration in the morning is 125 μg./100 ml. and in the evening 80 μg. High serum iron concentration is found in hemochromatosis, acute hepatitis, untreated pernicious anemia and during considerable iron uptake. Low serum iron concentration is found in conditions of iron deficiency and in conditions with obscure relation to iron metabolism, all, however, related to stress, as in infectious diseases and acute conditions inducing eosino-

penia (epinephrine shock, anaphylactic shock and experimental fractures)

Ulrik Feldthusen, Vagn Larsen and Niels A. Lassen[4] (Copenhagen) investigated serum iron concentrations after operation with special regard to adrenocortical function. Serum iron and hemoglobin concentrations, number of eosinophils and reticulocytes and urinary excretion of 17 ketosteroids and 11-oxysteroids were measured

After minor operations no change was noted After major operations, within 24 hours serum iron concentration was usually below 60 μg /100 ml, rising slowly during the following days with maximum duration of 12 days. Eosinopenia, lasting one to three days postoperatively, was noted in most patients There was a transient rise in hemoglobin concentration. Anemia and reticulocytosis did not develop In 4 of 10 patients, a small rise in 17 ketosteroids was noted on the first postoperative day, with 11-oxysteroid excretion in 9 remaining high four to six days

Three possible causes for low serum iron concentration in the postoperative period are blood loss during operation, disturbed sleeping rhythm in the postoperative period, and possibly disturbed hormonal regulation of serum iron concentration, i.e., increased adrenocortical activity A fall of serum iron concentration is characteristic of stress caused by operation occurring concomitantly with increased adrenal activity, whether or not secondary to it

Homologous Serum Jaundice and Pooled Plasma Attenuating Effect of Room Temperature Storage on Its Virus Agent. J Garrott Allen, Henry S Inouye and Carolyn Sykes[5] (Univ of Chicago) state that pooled plasma drawn from carefully screened, healthy donors and stored in liquid form at room temperature six months or longer before use is clinically satisfactory and carries less hazard of homologous serum jaundice than does whole blood No case of homologous serum jaundice was detected from such plasma in 294 patients, despite donor exposure 11 14 times greater in these patients than in patients given only blood

(4) Acta med. scandinav 147 311-3*3, 1953
(5) Ann. Surg 138 476-486 September 1953

Of 6,459 receiving blood only, 31 had homologous serum jaundice, and of 620 receiving blood and pooled plasma, 4 were so affected. Many of the objections to room storage of pooled plasma at 78-96 F for six months before use appear to be unwarranted

Human volunteer studies thus far conducted do not duplicate or necessarily apply to the problem of plasma pooling encountered in the community blood bank. The volunteer data seem to support rather than contradict clinical experience with liquid plasma despite the fact that in the volunteer studies the source of the virus used was patients currently sick with homologous serum jaundice The differences in titer and virulence of viruses obtained from patients at the height of their disease and from the healthy donor who is a "carrier" of the virus is important. It is the healthy "carrier" donor who seldom gives any history suggestive of homologous serum jaundice, either previous or subsequent to his donation, who is responsible for the disease encountered in transfusion of pooled plasma or blood in clinical practice The high titered virulent virus obtained from the patient sick with homologous serum jaundice, as employed in the volunteer studies, is not encountered in normal blood bank procedures.

The room temperature storage procedure as used at the University of Chicago Blood Bank offers a practical and simple method for preparing plasma pools in community blood banks It leaves unsolved, however the prevention of homologous serum jaundice from blood transfusions When a safe method to rid blood of this hazard is found, it should also solve the pooled plasma problem, regardless of whether the final product is stored in the liquid, dried, frozen or refrigerated state

[This work should have great practical significance in military operations. —Ed.]

Intra-Arterial Transfusion Potassium Hazard D G Melrose and A O Wilson[6] (Postgrad. Med School, London) believe that intra arterial transfusion can be life-saving and is often the method of choice for blood replacement. As this usually is an emergency measure and large amounts

(6) Lancet 1 1266-1268 June 27 1953

are often given, stored blood must usually be used Plasma potassium levels of 35 mg %, not uncommon in blood stored for up to three weeks, are just below the fatal concentration in man (about 40 mg %) In shock, oliguria and decreased cardiac output potentiate the effect of any increase in plasma potassium level These same factors operate in the similar but smaller changes in cardiac output and renal function occuring in all surgical patients

Much of the potassium which has diffused out of the red blood cells may be removed by decanting the plasma from stored blood and reconstituting with physiologic saline or salt free dextran Over 40% reduction in potassium level is obtained

The effect of potassium on the heart is governed by the direction of flow of the transfusion (which may be retrograde if cardiac output is low) the extent to which it is diluted in its passage to the heart and the immediate state of potassium metabolism in the recipient

A modified Henri-Jouvelet rotary pump is ideal for rapid 'ransfusion. To increase the rate of delivery, the handle 'riving the roller is turned manually Flow rates of about 00 ml/minute may be achieved with standard transfusion bing with pump rotation speeds of 60/minute The best te, though not known is probably about 300 ml/minute e danger of gas embolism is remote, and no demonstrable ..eration of the blood is brought about during one passage through the pump

In intra arterial transfusions it is inadvisable to inject anything but blood, avoiding dextrose solutions particularly There is insufficient knowledge of the immediate fate of the blood in the circulation, and the advantages of the method must still be assessed

Importance of Potassium after Operation George C Henegar[7] (Oakland) states that deficiency or excess of potassium after surgery must be diagnosed and treated accurately The intracellular fluid contains 115 mEq/L potassium and the extracellular fluid contains 5 mEq/L Usually there is a daily potassium excretion of 60-90 mEq in the urine and 10 mEq in the feces The average adult sec...

(7) California Med. 79 386-389 November 1953

about 8,200 cc fluid into the digestive tract each 24 hours A patient with intubation, vomiting, diarrhea or intestinal fistula may lose a significant amount of fluids and electrolytes from the digestive tract If only dextrose in water and/or saline is replaced, there will be a drop in serum potassium content and characteristic symptoms of anorexia, malaise, apathy, weakness, abdominal distention and hypo chloremia. The ECG changes of moderate hypopotassemia are low, wide T wave with prolonged Q T and low voltage in all leads As potassium is further depleted the T wave is inverted, S-T depressed and Q T further prolonged. Hyper potassemia causes elevation of T wave with progression to a biphasic pattern as the potassium content reaches toxic and lethal levels

Many patients who have had prolonged disturbance in nutrition may have "subclinical" hypopotassemia. Replacement of potassium excreted daily in the urine is ideal prophylaxis Avoidance of pathologically low potassium values is usually no problem if the patient can begin adequate oral intake within three to five days postoperatively If kidney function is good, patients may safely receive 60-90 mEq potassium daily in parenterally administered fluids until oral intake is adequate If potassium deficit develops replacement should be calculated on the basis of the total amount of water in the body Adequate renal function is necessary The response of the serum potassium level may be slow Potassium chloride solutions are available in which 1 Gm. is equal to 13 3 mEq potassium ion when diluted to 1 L These solutions can be added to any other solution for intravenous administration.

Limitations of Postoperative Hydration Eugenio Mauro[8] (Univ of São Paulo) points out the serious and sometimes fatal complications that may result from indiscriminate use of routine formulas for postoperative hydration. Water balance calculations, based on needs of normal persons, may be completely unsuited to a surgical patient Mere introduction of water into the body does not insure its utilization. Individual cells may die of dehydration even though the patient has been given fluid in edema producing quan

(8) Rev Hosp Nt. Sa. Aparecida 6:16 27 Jan.-Feb. 1953

tities Infusion of fluid may be followed by abundant diuresis which, though apparently satisfactory, depletes the body of essential and sometimes irreplaceable electrolytes

Individual response to parenteral administration of glucose is extremely variable, and pre and postoperative tolerances of a patient for glucose may differ substantially Diuresis resulting from glycosuria produced by faulty administration of glucose nullifies the attempt to supply the body with water and leads to loss of electrolytes Glycosuria, which almost always develops when glucose is given in a 10% concentration at slow rate (or in lesser concentrations at greater speeds), also makes it impossible to supply all of a patient's caloric requirements by administration of glucose alone Other solutions should therefore be used for this purpose Sodium chloride which, unlike glucose, is not metabolized, should be given only if there is a genuine saline deficiency or when an increased volume of circulating fluid is desirable Danger of provoking edema and temporary postoperative reduction in salt excretion resulting from renal insufficiency are contraindications to administration of saline solutions Obviously it is imperative to consider carefully each patient's requirements before postoperative fluid therapy is prescribed

[Everybody knows these things but sometimes they are forgotten.—Ed.]

Intravenous Infusion of Coconut Water Ben Eiseman[9] (Washington Univ) presents laboratory and clinical data concerning coconut water as a source of fluid for intravenous use in areas of the world where the usual solutions cannot be prepared The husk is cut back to expose the soft "eye" which is sterilized with alcohol and the water is removed aseptically through a large bore cannula. Another needle serves as an air vent. The water is filtered through sterile surgical gauze in a funnel and collected in a blood donor bottle

Coconut water of low fat content from unripe Cocos nucifera between 170 and 220 days of age was tested in Bangkok, Thailand and St. Louis In no instance was there aerobic, anaerobic, bacterial or fungus growth in cultures of freshly drawn coconut water No gross or microscopic

(9) A.M.A. Arch. Surg. 68 167 178 February 1954

evidence of hemolytic activity was found. Electrolyte com position varied somewhat according to age of the coconut but in general had the characteristics of a hypotonic intra cellular fluid Total cation or anion content averaged 81 mEq /L Average pH was 5 6 Buffering capacity of coconut water is low because the anions are largely chloride and phosphate Potassium forms the largest proportion of the cations, concentrations of magnesium and calcium are also high.

No untoward reactions were noted in any dogs receiving uncontaminated coconut water No evidence of sensitivity developed even after prolonged administration Precipitin titers and cutaneous sensitivity studied in rabbits given coconut water intravenously showed no sign of sensitivity reaction or precipitin titer change

A total of 26 infusions of coconut water was given 21 patients, none acutely ill Discomfort was felt in smaller veins when the rate of infusion was fast Minor reactions—urticaria and pyrexia—each occurred once There were no signs of potassium intoxication It may be that high con centrations of calcium and magnesium increase the body tolerance to relatively high potassium levels

[Interesting observations that may be useful some day—Ed.]

Transfusion Reactions and Their Treatment Julius W Davenport, Jr[1] (Southern Baptist Hosp., New Orleans) believes any alleged blood reaction, during and for 48 hours after transfusion, should be considered potentially hemolytic until proved otherwise Rapid diagnosis is essential.

The most urgent laboratory procedures are recross matching classification of recipient and donor blood for group and Rh_0 (D), examination of recipient's blood and urine taken after transfusion reaction for free hemoglobin, testing of recipient's blood for irregular antibodies by means of enzyme treated cells and indirect Coombs tests, and examination of a citrated or oxalated postreaction sam ple from the patient for presence of agglutinated donor cells. Less urgent procedures are complete classification of blood of recipient and donor tests for isoagglutinin lev els and irregular antibodies, and examination of urine for

(1) Am. J Clin. Path. 24 221-228 March, 1954

casts and red cells Additional diagnostic aids and therapy guides are tests for serum bilirubin, urine urobilinogen and urobilin, tests for azotemia in the event of urinary suppression Kidney and liver function tests and hematologic studies

In case of a reaction, the transfusion should be stopped immediately and the laboratory notified An indwelling catheter should be inserted and 1/6 M sodium R lactate administered intravenously Blood pressure, pulse rate and temperature should be recorded as soon as possible The patient should be reassured and sedation given Chills may be treated with blankets, hot toddy or 3 or 4 drachms of spirits of ammonia in ½ glass of water Whenever a bacterial reaction is suspected, blood cultures should be made In case of dyspnea or severe shock, oxygen by B L B mask gives relief.

Allergic reactions, by far the most frequent, may be treated and prevented with administration of antihistamines Hemolytic reactions may be followed by hemorrhage in the form of oozing from the gums, mucous membranes or operative fields It may be advisable to administer fibrinogen and calcium intravenously

Shock must be treated with adequate volumes of albumin, dextran or both or compatible whole blood given in the presence of anemia Fluid administration should not exceed that required to restore blood pressure and maintain water balance Conservative administration of not more than 500 cc of 1/6 M sodium R lactate is suggested if the reaction of the urine is acid.

During renal suppression fluids administered should be limited to the calculated output During recovery when the urine output becomes copious, salt and fluid intakes are raised

Jaundice is related to the amount of blood destroyed When renal suppression is severe and jaundice is increasing supportive treatment of the liver is indicated

Low Sodium Syndromes of Surgery Outline for Practical Management Francis D Moore[2] (Harvard Med. School) observes that of the 2 700-3 000 mEq sodium in a normal

(2) J.A.M.A. 154 379 384 Jan. 30 1954

70 kg male, 1,800-2,000 mEq is in the extracellular including the plasma. The concentration of sodium is 5 7.5 mEq /kg intracellular water and 138-143 mEq / tracellular water There is also a large amount of sod the skeleton. The normal daily diet contains about 10(sodium, and urinary excretion is the same if the pe in zero balance In a normal person, a low sodium di not readily lower plasma sodium concentration beca sodium conserving mechanisms However, when the heart, liver or kidney disease and a tendency to wa tention, a low sodium diet may be associated wit serum sodium concentration Adrenal cortex hormon crease urine sodium concentration by sodium resorpt the renal tubules The pituitary antidiuretic hormone to promote moderate sodium excretion from the kidne to favor water resorption from the distal tubule to siderable extent Intense antidiuretic activity results i nounced lowering of sodium concentration in the seru slight lowering of total body sodium content.

A low salt syndrome in a surgical patient must be nized and treated quickly and adequately It is necess determine the cause and treat the patient, not the conc A careful history and physical examination are ess Laboratory studies aid in intelligent management The three basic types of low serum sodium which must b ferentiated in order to plan treatment

1. Normal body sodium and body water with low sodium concentration. This "sodium paradox" is pres normal persons who are severely injured or have had surgery There is normal weight loss and no unusua of sodium in the urine Treatment consists in early an tion and food. Body water should be maintained by ancing insensible losses accurately Weight shoul checked daily There should be a gradual weight d until caloric intake is again resumed A moderate ar of sodium, up to 100 mEq intravenously, can be give first day If a toxic concentration of plasma potassiu exists, 300 cc of 3% sodium chloride solution can be as an antidote to potassium toxicity Characteristic c is gradual recovery of serum electrolytes to normal l

2 Normal body sodium but too much water with low serum sodium concentration "Water intoxication" or sodium dilution is found when too much water has been administered in the presence of an antidiuretic effect, and is seen in patients with heart, liver or kidney disease It is also found after injury or major surgery when too much sodium free water has been given There is no weight loss or renal or extrarenal loss of sodium Edema, azotemia and low hematocrit reading and serum protein concentration may be noted Treatment consists of restriction of fluid so that the patient may lose weight and achieve water balance The caloric intake should be raised and blood volume maintained at normal level One infusion of 300 cc of 3% sodium chloride may result in a transient elevation of serum sodium concentration and redistribution of water and electrolytes toward normal. Administration of too much sodium will lead to congestive heart failure The patient must lose water and will do so if kidney function is normal.

3 Low body sodium with low or normal body water True "sodium deficiency" occurs when there is sodium loss in excess of water The patient is acutely ill, dehydrated, acidotic and azotemic In most instances he shows extrarenal losses by vomiting fistula diarrhea or intestinal obstruction The sodium loss may occur via the urine as a result of renal or adrenal disease A test dose of desoxycorticosterone acetate is useful in differentiating the organ at fault when sodium deficiency results from urinary loss There are two categories of sodium deficiency In one, the extrarenal loss is high and urine sodium concentration low, in the other, extrarenal loss is low but renal loss is high This latter group is due to adrenal failure in which urine sodium concentration falls in response to desoxycorticosterone acetate, or to renal tubular failure, in which the urine sodium concentration does not fall after administration of desoxycorticosterone

Treatment of typical extracellular dehydration due to extrarenal loss consists in giving adequate water and salt Probably 300 mEq sodium daily is the upper limit for sick and elderly patients The history of fluid and electrolyte loss is important in determining the amount of water and

salt to be given All losses should not be replaced at one time Treatment of salt losing adrenal failure consists in giving water, salt, desoxycorticosterone acetate and cortisone Renal failure must be carefully assessed if the kidneys are at fault in water and sodium loss The treatment of this type of true sodium deficiency is to give water and salt to balance The urine sodium concentrations must be measured daily

Some Apparent Anomalies of Potassium Metabolism. Ian W MacPhee[3] (Univ of Liverpool) summarizes the more important contributions to knowledge of potassium metabolism Despite the cause, the symptoms of hyperkalemia are similar and consist of weakness and hypotonia of skeletal muscle leading finally to paralysis, dyspnea with gasping respirations, cyanosis, abdominal distention, nausea and vomiting, cardiac enlargement with systolic murmurs and ECG changes With progressive serum potassium deficiency, the ECG shows a prolonged Q T interval, decreased height or inversion of the T wave rounded and prolonged T wave, depression of the S-T segment, and inversion of the P wave, extrasystoles and heart block.

Hyperkalemia is a danger only in renal failure and after the injection or absorption of potassium salts The ECG changes in dogs correlate directly with the serum potassium concentrations and include (1) increased amplitude and reduced duration of the T waves at 5-7 mM. potassium/L , (2) depression of S T segment at 8-10 mM./L., and (3) intraventricular block at 10 mM /L., disappearance of the P wave at 9 11 mM /L and cardiac arrest at 14-16 mM./L

Deficiency may be induced by prolonged reduction of intake or by excessive loss through vomiting by diarrhea or in the urine Surgery, injury and other stress conditions may accentuate the loss The symptoms of potassium depletion are due to reduction of intracellular, not serum, potassium content It is therefore unwise to wait for biochemical evidence of serum potassium depletion before making the diagnosis of deficiency With adequate renal function, deficiency must be expected in all patients who have undergone major surgical procedures if oral feeding is not

(3) Brit. M. J 2 528 531 Sept. 5 1953

possible by the fourth day, if deficient intake has occurred before operation, if losses are augmented by vomiting, diarrhea, dehydration or saline infusion, and if potassium is not supplied.

Potassium deficiency states usually exist with deficiencies of other ions and the total imbalance must be corrected If the intravenous route of replacement is used, no more than 20 mEq potassium/hour in a solution with a maximal strength of 80 mEq /L. should be administered. Renal function must be adequate and means for rapid estimation of serum potassium must be available Signs of potassium intoxication may occur as a result of too rapid parenteral replacement of cellular potassium deficiency

The mechanism of the gradual rise of serum potassium during anuria remains in doubt but may be a result of increased adrenocortical activity, liberation from damaged muscle or from protein catabolism of starvation. In treatment high carbohydrate diets are advocated but if extracellular potassium concentration has already reached toxic levels, some form of dialysis may be necessary

Unlike the effects of potassium deficiency, the toxic effects of increased body potassium are usually related to the extracellular concentration of the ion

Homeostatic Limits to Safe Parenteral Fluid Therapy Nathan B Talbot, John D Crawford and Allan M Butler[4] (Harvard Med. School) state that the inorganic solutes contained in fluids for parenteral administration are the important determinants of water solute relations in body fluids and urine, whereas dextrose is quickly metabolized and exerts only a small effect on the osmolar concentration of body fluids

The minimal water requirements of a person not under stress and receiving only parenteral fluids is equal to the sum of his minimal renal and extrarenal water losses minus the water of oxidation of glucose infused and body substance catabolized and the water content of the catabolized body substance. Insensible water loss of sick patients has been estimated as 1,000 cc./sq m./day Gastrointestinal losses are assumed to be zero in patients receiving only

(4) New England J Med 48 1100 1108 June 25 1953

fluids parenterally Water of oxidation plus water content of catabolized body substance has been taken as 270 cc /sq m./day Minimal urine water is considered a function of urine water concentration and urine solute output Minimal urine water concentration has been taken as 0 7 cc./mOsm. Endogenous urine solute excretion has been estimated as 200 mOsm /sq m./day for persons given enough water to meet water needs and enough dextrose to eliminate ketosis and to minimize nitrogen catabolism The smallest quantity of dextrose that will permit such a reduction of solutes in the urine is 50-75 Gm /sq m /day Total urinary solute output is assumed to be equal to the sum of the endogenous plus the exogenous inorganic solutes contained in the infused fluid. Minimal urine volume, then, is equal to the total urine solute output times the minimal value for urine water concentration (cubic centimeters of water/milliosmol) observed under conditions of need for water conservation The minimal water requirement is less when a solution of dextrose without inorganic solutes is infused than when a solution containing dextrose in isotonic saline is used If the minimal water requirement is not met, the patient is obliged to supply the difference between water intake and minimal water requirement by expending a portion of his body water stores, and a tendency to decreased body water concentration results The earliest signs of decreased body water concentration are thirst and oliguria Later signs are hemoconcentration, fever and circulatory failure

Patients under severe stress as a result of acute illnesses often lose the capacity to excrete the highly concentrated urine (0 7 cc /mOsm.) that can be formed by patients not in stress These patients need more fluid to balance their minimal water expenditures

Simple dextrose solutions are apt to induce water intoxication in anyone if they are given more rapidly than 2,700 cc /sq m /24 hours The danger of induced water intoxication is increased considerably when patients are given such commonly used drugs as morphine or its derivatives or barbiturates In this circumstance tolerance to simple dextrose solution may be reduced to 1 100 cc./sq m./24 hours The addition of as little as 80 mOsm. of inorganic solute

(e g., 40 mEq of total base) per L dextrose solution will increase tolerance severalfold

Isotonic saline in dextrose solution is incapable of causing water intoxication but is so rich in inorganic solutes and so poor in physiologically free or available water that as much as 5 L/sq m/24 hours may be required to meet the minimal maintenance water requirement of patients under severe stress. Administration of this much sodium chloride (43 Gm. or 750 mEq/sq m./day) is apt to induce excessive edema formation In fact, patients under severe stress given isotonic saline solution can paradoxically show excess sodium chloride and water retention (edema formation) while suffering at the same time from water deficit as shown by hypertonicity of body fluids and oliguria

The difficulties inherent in parenteral use of either solutions of dextrose in water or dextrose in isotonic saline can be reduced by the use of one-half to two-thirds isotonic saline in dextrose solution (i.e , 2 parts of dextrose in saline solution plus either 1 or 2 parts of dextrose in water) Such solutions appear suitable for the initial hydration of most severely sick patients. However, these solutions are inadequate for prolonged therapy because they lack ions essential for repair of intracellular deficits

Solutions containing intracellular (K, PO_4) as well as extracellular (Na, Cl, HCO_3) ions in physiologically tolerable amounts can easily be constructed. Results obtained by infusion of hypotonic multiple electrolyte solutions at rates of 1.5 to about 3 5 L/sq m./24 hours suggest that they may have wide usefulness in helping patients with basically normal endocrine renal homeostatic systems to cure themselves of disturbances in fluid and electrolyte metabolism Newborn infants and patients with advanced nephritis, cardiac failure, Addison's disease, diabetes insipidus, hypoparathyroidism or marked dehydration with reduction of circulatory and renal efficiency may not tolerate these multiple electrolyte solutions.

Nonprotein Nitrogen Changes in Serum and Plasma of Rats Following Thermal Injury Hyman Rosen and Stanley M. Levenson[5] (Med College of Virginia) utilized ultra

(5) Proc. Soc Exper Biol. & Med. 83 91 9 May 1953

filtrates of plasma and serum from normal and thermally injured rats in a study of nonprotein nitrogen changes after thermal injury Rats were burned deeply over approximately 30% of the body surface and blood was collected 11 12 hours afterward. Absorption spectra were obtained before and after in vitro ultraviolet irradiation of the serum ultrafiltrates Changes noted in the spectrum of serum ultrafiltrate in injured rats are consistent with a qualitative and/or quantitative modification in serum amino acids, free and combined, and with the appearance of purine-containing compounds

In burned animals, there was a rise in plasma urea and free and combined amino nitrogen. Almost the entire increase in filtrable nitrogen in serums of rats after thermal injury consisted of urea and free and combined amino nitrogen in their normal relationships Specific amino compounds were measured by ion exchange chromatographic and colorimetric ninhydrin technics The results obtained by these methods for the amino acids of plasma ultrafiltrates in normal rats were similar to values obtained by others for rat plasma amino acid with the use of microbiologic technics. In the plasma ultrafiltrate of injured rats, there are increases of some amino acids, particularly tyrosine, phenylalanine and histidine, whereas values of other amino acids decrease Quantitatively, most of the increase in amino nitrogen is made up of a forepeak (taurine?) and an amino acid conjugate The amino acid conjugate includes a large fraction unaffected by hydrolysis and a few of the common amino acids The composition of the conjugate is similar in normal and injured rats

NUTRITION

Experiences with Intravenous Alcohol Therapy are reported by G Grundmann[6] (Univ of Tübingen) Alcohol, because of its wide therapeutic margin of safety with respect to breathing and circulatory centers of the brain, may be used successfully in the relief of postoperative pain, as a morphine substitute

To obtain analgesia, a 7 10% solution of alcohol was given intravenously Higher concentrations, because of resultant thrombosis, embolism, hemolysis and kidney damage, are dangerous The desired effect is achieved with 15 cc./hour Total daily intake immediately after operation totaled 100-180 Gm within 24 hours The alcohol was infused at a rate of 40-80 drops/minute For more rapid effect, 150 cc. of a 7% solution was given within the 20-30 minutes immediately after operation. Vitamins, sulfonamides, chlortetracycline and oxytetracycline were added to the infusion fluid without loss of therapeutic strength of any substance. Procaine should not be given at the same time as sulfonamides

The nutritive effects of alcohol were obtained by the administration of 100 cc glucose, 35 cc. of 96% alcohol and distilled water to 500 cc. Use of 1,500 cc of this solution within 24 hours provided the patient with 1,935 calories Proteins were supplied by the administration of 500 cc blood

Alcohol is an antiketogenic substance Postoperative acidosis, of great significance to the surgeon, may be caused by ketone bodies, the products of intermediate metabolism, or the circumstances that cause shock. When caused by ketone bodies, alcohol-sugar infusion is specific therapy

Alcohol has an analeptic effect and may therefore be administered in shock and collapse It causes vasoconstriction in the splanchnic area and increases blood pressure and minute volume It is recommended in angina pectoris In cardiac patients, the addition of fluid should be about

(6) Hel. chir. acta 20 60-71 March, 1953

1,000 cc /24 hours, not more Strophanthin may be added to the solution A slight increase in pulse rate and a 0 5 1.0 degree drop in temperature results It has a diuretic effect.

In fatal poisoning the blood content of alcohol is 5%, as against the 0 3 1 0% resulting from alcohol therapy Children have not been given this therapy, nor have pa tients with epilepsy or gout In 80 gallbladder and other bile passage operations, no ill effects were noted.

Protein Metabolism of Surgical Patients is discussed by F E Revers and C Eikelenboom[7] (Univ of Utrecht) Post operative examination of plasma proteins in a large number of patients has made it clear that in many there is a reduc tion in the albumin fraction. In most cases it seems possible to infer a low albumin percentage from low erythrocyte and hemoglobin levels Since plasma proteins are constantly in balance with the body stores, some idea of the protein reserve stocks can be obtained by ascertaining the plasma protein level. Especially in surgical patients the protein balance is endangered with hypoalbuminemia causing ede ma, poor wound healing increased sensitivity to shock and lowered resistance to infection.

The negative nitrogen balance seen postoperatively is due not to increased nitrogen loss but to decreased nitrogen intake Post traumatic protein breakdown is no longer seen in modern operating technic, because trauma is reduced to a minimum by preoperative treatment, proper operating technic, modern anesthetic agents, transfusions before and during operation and prophylaxis against infection It is necessary to combat the consequences of nitrogen loss by means of good nourishment postoperatively Adequate nour ishment may keep the nitrogen balance in equilibrium

In administration of nutrients, the oral route is preferred to the parenteral. Blood transfusion, infusions of plasma or albumin can raise a low protein spectrum for only a short time They are suitable only in urgent cases, immediately before and after operation If postoperative nourishment cannot be given by mouth, recourse should be had to the amino acid mixtures the caloric value being of primary importance The usual amino acid glucose mixtures are

(7) Arch hir neerl 5 81 107 1953

hardly suitable because of their poor caloric value Addition of alcohol affords some improvement A 7 5% alcohol infusion with 5% protein hydrolysate and 5% glucose has a caloric value of 820/L Addition of fat emulsions to glucose amino acid mixtures will probably solve the problem

---

WOUNDS AND WOUND HEALING

The following series of articles on burns is especially interesting because it illustrates the different emphasis which is placed on various aspects of the treatment by different surgeons. For example, Jackson is particularly interested in the question of infection and in a means of diagnosing the depth of the burn. Moyer and the Mayo Clinic group of Coventry and Logan emphasize especially the metabolic aspects of treatment. Barrett Brown and his associates have made an important contribution by showing how acute burns can be covered temporarily by homografts which are obtained conveniently at autopsies. Wilde and Derry make a plea for the use of tryptar in the debridement of burns for early skin grafting.—Ed.

Treatment of Burns Exercise in Emergency Surgery According to Douglas MacG Jackson[8] (Birmingham), the complications of burns are responsible for the mortality and morbidity of burns, shock being the commonest cause of death and infection next. Scarring is the chief cause of preventable deformity and disability All complications are easier to prevent than to cure Shock can be prevented by early and adequate restoration of fluid and infection by protection of the burn against colonization with pathogenic bacteria, immobilization and early grafting Contractures and fibrosis *may largely be prevented by early elevation,* prevention of infection, correct positioning of the patient and early debridement and grafting Results of treatment are measured by mortality, healing time and disability

Of 2,022 severely burned patients hospitalized, usually within a few hours of injury, during 1948-52, 104 died. The death rate increased with the age of the patient and the extent of burned body area. Of 87 whose deaths actually were due to burns, 46% died of shock 33% of infections, 4% as a result of surgery and 7% of miscellaneous causes In 90% of the fatal cases cause of injury was flame burn

---

(8) Ann. Roy Coll. Surgeons England 13 236 257 October 1953

Healing time was considered as the time from injury to complete epithelialization and separation of all scabs. Of 1,578 burns, the mean healing time for partial skin loss was 20 days, for complete skin loss 51 days and for extensive burns requiring shock treatment 72 days The mean healing time for full thickness burns of less than 2% surface area, with primary excision and grafting, was 34 days and *without primary excision and grafting 46 days*

Assessment of disability included anatomic function and industrial fitness Of 743 patients, 90% regained full function of the burned part Of the 75 patients with impaired function, 56% returned to their previous work and 25% returned to suitable work. Two thirds of the disabling burns occurred during unconsciousness or were caused by inflammable liquids, molten metal or electric contact. The incidence of impaired function increased with age and was four times as common in the upper limb as in the lower

The treatment of burns is an emergency The value of primary excision and grafting for a small full thickness burn lies in the provision of quick and sound healing When a joint is opened by a deep burn, infection and ankylosis almost certainly follow unless emergency cover is obtained with some type of flap Necrotic tissue, hematomas, dead spaces and open channels of infection cause fibrous tissue which results in twisted and frozen joints Old burns can be treated by immobilizing the part in the position of function until ready for definitive surgery The burned area should be covered by a graft as soon as possible Exposure treatment is reserved for burns of the face and buttocks, since they cannot be covered efficiently When there is no special indication for open treatment, closed dressings are preferred for full thickness skin loss burns.

Facilities required for adequate burn therapy include ambulance service, adequate number of beds, separate operating room, 24 hour staff duty, separate shock rooms and facilities to minimize bacterial contaminations The last includes early first aid, segregation of recent and old burns before dressing effective bacteria proof dressing appropriate local and general chemotherapy, infrequent dressings air conditioned dressing rooms and early operation.

Separate burn units for the treatment of burns provide patients with better treatment and are economical because they provide shorter healing times and less disability. General surgeons and plastic surgeons should co-operate in treatment.

Diagnosis of Depth of Burning. Douglas MacG. Jackson[9] (Birmingham) undertook to find physical signs for early diagnosis of depth of necrosis in burns, since the treatment of choice for burns destroying the whole thickness of skin is primary excision and immediate skin grafting.

Most burns and scalds are deepest in the center and most shallow at the periphery, so that the appearance tends to be one of concentric zones. The appearances during the first week are due to the state of the superficial capillaries and the blood in them and indicate intensity of burning only. In the next two weeks the superficial necrotic layers of the dermis separate and the deeper layers of the skin are exposed. These appearances have a definite significance with regard to depth of burning.

During the first day after injury the burn is characterized by three concentric zones which illustrate three degrees of intensity of burning. (1) The zone of hyperemia blanches on pressure and becomes cyanosed with the rest of the limb if a cuff is applied proximal to the burn for 10 minutes. The zone becomes a deeper red by the fourth day and is dry and healed by the seventh. (2) The intermediate zone of stasis is initially red and blanches on pressure. On application of an exsanguinating tourniquet, the zone becomes white and, on removal, color returns as it does to the rest of the limb. If the circulation is arrested for 10 minutes, the zone of stasis remains red while the rest of the normal skin becomes cyanosed. This suggests that oxyhemoglobin in this zone is not reduced but that metabolism is much diminished or has ceased. By the *end of 24 hours*, circulation in the superficial vessels has ceased. Between the third and seventh days, the red and white *mottling* of the zone of stasis turns white. (3) The *central* zone of coagulation is characterized by complete obliteration of the lumens of the vessels in the subpapillary plexus and the capillary loops.

(9) Brit. J. Surg. 40:588-596, May 1953.

The appearances of the intermediate and central zones have no significance in diagnosis of depth of burning Initial white coagulation of the skin does not necessarily imply full thickness loss

In the second and third weeks *epithelialization* begins. Abundant speckling in the second week means that the lesion will be covered with skin of good texture in the next two weeks A central area of scattered or no speckling with in a surrounding zone of abundant speckling should be regarded as virtually complete skin destruction, and grafting should be undertaken without delay

Burns are tested for sensitivity to pinprick with a sterile hypodermic needle held in a sterile hemostat Any appreciation of pain, as opposed to touch, signifies partial skin loss only, whereas full thickness losses are always analgesic. Analgesia associated with deep partial skin loss is more common on the face, scalp, palms and soles than on areas of nonspecialized skin. Analgesia is common in superficial burns caused by alkalis and acids

Burns with molten or red hot metal are almost always full thickness. High temperature liquids usually cause mixed lesions Acid burns frequently cause partial thickness skin loss even though they may be white and analgesic immediately after injury

No physical sign of full thickness skin loss appears during the first week if it was not present on the day of burning The optimal time for grafting is as soon as the limits of full thickness loss can be diagnosed and not later than three weeks The more extensive the burn, the more important it is to keep to this timetable

Treatment of Severe Thermal Injury Its Development and Accomplishments during Past Century II. Carl A. Moyer[1] (St Louis) analyzes two methods of treating burns. In the first an occlusive thick layer dressing was applied over dry fine meshed cotton gauze without debridement and with saline irrigations only if the wound was covered with detritus Morphine was given intravenously as needed, injection of Hartmann's solution was started and whole blood transfusion begun A cold salt solution, 4 Gm sodium

(1) West. J Surg. 62 107 120 February 1954

chloride and 1 5 2 Gm sodium bicarbonate per quart, was the only clear fluid permitted orally Penicillin was administered parenterally Dressings were changed under aseptic technic after 8 14 days Pyruvic acid paste was applied after the first dressing Skin grafting was done as soon as possible Blood was given to maintain hemoglobin concentration above 10 Gm./100 ml Burns in the second series were treated with plasma according to hematocrit and body surface rules, the wounds dressed with occlusive dressings overlying sulfathiazole covered gauze Blood was given only after fall of hemoglobin or red cell count to anemic levels, and water was permitted ad lib No pyruvic acid was used

Only persons under 61 years were included in the analysis because of the inordinately high mortality from burns in the aged A thermal injury of 13% of the body is attended with a mortality of 50% in those over 61 while one of 46-56% is necessary to produce a 50% mortality in younger persons. Only burns or scalds involving more than 25% of the skin were included

Mortality in the first series was significantly less, 28 6% than in the second, 58% The greater therapeutic efficacy of blood and saline solution over plasma is ascribed to greater effectiveness in combating shock Persons with large burns die more slowly and fewer die when blood and buffered saline are used to treat peripheral circulatory failure The mean length of life after a 75-90% burn was 6 13 days with the first method and 0 79 days with the second Burns of 46% of the body surface kill 50% of these treated with plasma, while an injury of 56% is required to kill 50% treated with blood and buffered saline There is no difference in mortality between the two methods for burns of 15-40 and 65 100% of the skin.

Further improvement in burn therapy will come from rigid application of aseptic technic, knowledge of metabolic defects from skin destruction, shortening of the time before a viable covering is applied to a full thickness injury, acquisition of basic knowledge of biochemical effects of heat and radiation on the skin and reduction of the chances of being burned.

Morphine should be given intravenously for pain after

peripheral circulatory failure has been overcome Intact blisters are left alone Detritus is removed by flooding with saline solution. If treated by exposure, the patient is placed on sterile sheets over sterile impervious covering If the burn is dressed, dry fine meshed gauze is preferred for initial dressing, covered by smooth layers of absorbent cotton wool or waste with a snug form fit cover Dressings are left in place 10-14 days or changed earlier if there are signs of sepsis or increase in tenderness on light pressure Application of pressure may do more harm than good.

Aims in treatment of shock are to maintain minute volume blood flow, volume of extra and intracellular fluid and composition of these fluids in ranges which will sustain life Mild peripheral circulatory failure is treated with buffered saline solution and severe failure with blood transfusions Salts are added to drinking water to prevent dilution of body salts and water intoxication. Enough blood and saline are *given to* (1) *maintain normal mental orientation*, (2) permit sitting without vertigo, tachycardia, hypotension or syncope, (3) sustain urine flow in excess of 10 ml /hour, (4) stop vomiting (5) maintain a firm pulse and (6) warm the toes, nose and ear lobes

Emergency Treatment of Burns in Children. Mark B Coventry and George B Logan[2] (Mayo Clinic) believe that treatment of the acutely burned child does not differ materially from that of the adult. Differences in age, size and fluid and electrolyte reserve must be considered The ability to withstand an extensive burn is inversely proportionate to age Hospitalization is recommended for deep burns, burns involving a surface equal to one extremity or more and *for infants* under 2 years *Codeine, morphine and* demerol® are used to control pain, which is usually transient Severity of pain and effect of the drug on the child are the guides to adequate dosage Tetanus antitoxin or a booster dose of tetanus toxoid should be given when the patient is first seen

The child should be observed for signs of shock. Whole blood is the best agent for treatment as it provides erythro-

(2) Postgrad. Med. 15 150-156 February 1954

cytes to replace those hemolyzed and the additional serum required

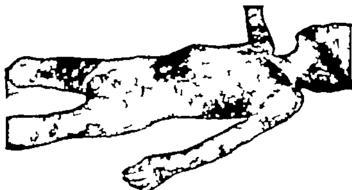
Fluid, food and electrolytes are required for daily needs and to replace losses at the burn site or by vomiting If a nasal tube is used it should not be left in place more than four or five days, to avoid ulceration of the lower esophagus A helpful rule in determining amount of fluid to administer is that of Evans, who gave 1 cc electrolyte solution and 1 cc colloidal solution per kg for each 1% of body surface burned In addition, 30-50 cc of 5% glucose per kg is given orally Urine output of 25 cc an hour indicates adequate function Physiologic sodium chloride and Ringer lactate solutions are recommended. To avoid water intoxication, Moyer's solution (3-4 Gm. sodium chloride or 1 teaspoonful, 1 5 2 Gm. sodium bicarbonate or ⅔ teaspoonful, and water, 1 qt) is given orally instead of pure water Blood chloride values should be maintained at 100-105 mEq /L and carbon dioxide-combining power at 20-25 mEq /L

Cortisone and corticotropin are of value in the stage of shock not responding to administration of blood They are of no value after 48 hours, in the stage of toxemia. During the third stage, that of anemia and hypoproteinemia, cortisone may be harmful, as it tends to mask infection If a surgical procedure is contemplated after administration of cortisone, the patient should be protected from adrenocortical insufficiency and shock with cortisone before, during and after the procedure Peptic ulcer and diabetes may be aggravated by cortisone

Burned areas should be handled aseptically and no more than superficial debridement practiced. The burn may be treated by the open method with the patient on a sterile sheet in a comfortably warm room, or by the closed method, with a bulky cotton dressing overlying dry, petrolatum or furacin* impregnated gauze and wrapped with a slightly compressing elastic bandage Dressings are changed every five to seven days Antibiotic therapy should be started immediately Penicillin is preferred, intramuscularly, with streptomycin and/or dihydrostreptomycin to broaden the

bacterial spectrum Adequate nutrition and supplemental vitamins are essential to good healing

Postmortem Homografts as "Biologic Dressings" for Extensive Burns and Denuded Areas Immediate and Preserved Homografts as Lifesaving Procedures James Barrett Brown and Minot P Fryer with Peter Randall and Milton Lu[3] (Washington Univ) stress the advantages of using large sheets of split skin homografts obtained from a single



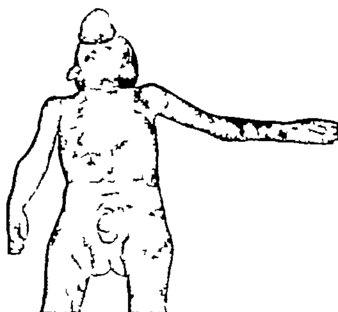




Fig 3 (top) —Patient, 17 days after burn
Fig. 4 (bottom, left) —Postmortem homografts, placed after eight days of cleaning areas. Lifesaving grafts, two weeks after application patient able to walk around in another's skin for several weeks before absorption.
Fig 5 (bottom right) —Patient on way to final rehabilitation with grafts of own skin and with restoration of flexion areas, function and features.
(Courtesy of Brown J B., *et al* : Ann. Surg 138 618 630 October 1953)

(3) Ann Surg 138 618 620 October 1953

patient soon after death, instead of smaller amounts from several donors Such grafts may be used immediately or stored for several days, either folded and wrapped in saline gauze and kept at about 4 C, or in 10% serum The authors envisage a central registry and collecting agency, not unlike the blood banks, if further study of methods of preservation make the plan feasible

"Takes" of homografts occur as with autografts and, although blood groups seem to have no effect on the "take," it is possible that the closer related a donor and recipient might be, the longer persistence might be expected. Permanent persistence has not been achieved in man except between identical twins. The weeks of persistence afford a viable body covering, respite from pain and fluid loss and lessen the extensive care Such a "biologic dressing" may be lifesaving if, during the respite, the patient produces good healing on his own part and recovers enough to permit transfer of autografts from his own body to remaining open areas (Figs. 3-5)

Partial thickness burns also might be dressed with split homografts to provide surface coverage until there is permanent healing Repeat sets of grafts have been used up to six times in the same patient Large solid sheets of grafts are far more advantageous than small pinch or rectangular grafts

Autografts are done as soon as the patient can endure the procedure and when the wound is clean enough and there is available skin

Split grafts should not exceed 1/4 1/3 skin thickness of the area and may be taken by any of the usual methods. The thicker the graft, the less chance of take, and as the grafts are temporary, thickness is not required

Enzymatic Debridement of Burns Tryptar According to N John Wilde and George Derry[4] (Fresno, Calif), of the three phases in the care of a burn patient, the first (immediate treatment of shock) and the third (grafting of the burned area) have been standardized, but the second phase (the interval between control of shock and grafting of the

(4) Plast. & Reconstruct. Surg 12 131 137 August 1953

burn) is still prolonged and no standard method of hastening the healing of the burn exists Although various agents have been used to debride the burned skin and allow grafting of the burn, no agent for wide and general use in the debridement of fresh burns has yet been found The authors report on the use of tryptar as a debriding agent in a fresh burn Tryptar is purified, crystalline trypsin and works best at pH 6 8-7 5, the usual pH of the burn surface Sörenson's buffer solution is supplied with tryptar in the event that the pH of the wound is not exactly right

Man, 50 was hospitalized for second and third degree burns of the entire left leg from ankle to groin 20 hours after injury Petrolatum gauze pressure dressings were applied to the entire leg except for two areas, one of 4 × 4 in on the lateral aspect of the thigh and one of 4 × 8 in on the lateral aspect of the lower leg Half the area on the lower leg was cross-hatched with incisions down to the dermis. Tryptar was then applied as a dust of the dry crystalline enzyme to the exposed area on the upper thigh, which was moist from serous weeping It was applied to both cross-hatched and not cross-hatched areas on the lower leg as a solution in the buffered diluent by moistening dressings which just covered it. A waterproof dressing was applied over both areas. Tryptar was applied every three hours, day and night

Within four days, some digestion of the burned skin was noted in the areas to which tryptar had been applied The 10th day after the burn it was possible to apply split thickness skin grafts to the area on the lower leg treated with moist dressings. The area on the upper thigh which had been dusted with the crystalline preparation was not ready for grafting until the 15th day The burn eschar on the leg not treated with tryptar at all was still adherent at this time and did not slough enough to permit skin grafting until the 21st day All of the skin grafts resulted in 100% takes

Tryptar produced no discomfort of any kind and the patient was perfectly at ease at all times Application of the dressings was neither complicated nor prolonged, and the instillation of tryptar, whether in solution or dust, was also very simple There was no reaction of any kind The tryptar had no effect on normal surrounding tissue The only disadvantage is the cost of the preparation but, since it cuts the length of hospitalization it considerably decreases the total expense to the patient

Thermal Burns from the Atomic Bomb Herman E Pearse and Harry D Kingsley[5] (Univ of Rochester) conducted

(5) Surg Gynec & Obst 98 385 394 April 1954

thermal burn experiments at the detonation of atomic bombs in which animals were exposed behind clear quartz, timing shutters, filters and fabrics in stations located at 14 different distances to cover the range from 1.1 to 43 calories/sq cm. Results ranged from no burn to a char Test animals were 91 white pigs, 8 black pigs and 15 dogs The white pigs proved the most satisfactory since fine gradations of color or coagulation of the skin were more readily detected The animals were anesthetized with urea urethane injected intraperitoneally

The animals demonstrated, for the first time, the characteristic gross and microscopic pathologic picture of primary burns from the atomic bomb The lesions closely resembled those caused by laboratory radiant energy sources In the laboratory, the time and intensity values of energy from the carbon arc have been obtained for burns of different degrees of severity in the white pig By using these values, the burns from the atomic bomb radiation could be assessed in terms of applied thermal energy

No burns were produced in any animal through the filter transmitting only ultraviolet light The burns received behind filters transmitting visible and infra red rays were about equal in severity Dark-colored animals had a deeper burn than white ones No burns were produced by the initial flash during the first 20 25 milliseconds Burns created by the second maximum or fire ball were equal in severity to those caused by exposure to the total thermal pulse At early tests, by means of a sliding shutter, the burn was found to be caused in the first ⅓ second after detonation of the bomb At subsequent tests, using a more refined timing shutter, it was found that (1) the skin burns produced in the period between 0.1 and 0.2 second after detonation were the most severe of any by a 0 1 second interval of the thermal pulse, (2) the major severity of thermal burns was attained within the first 0 3 second and the maximal severity within the first 0 5 second after bomb zero, and (3) no burns were produced after 0 6 second if the skin was shielded before that time These results indicate that evasive action is of little value

There was good relationship between the measured ther

mal energy and that determined by evaluating the skin burns from laboratory standards during the first 0.2 second. After this, the measured values were always significantly higher. No difference could be detected between the severity of the small and large area burns when sustained in the same animal or in different animals at the same station. Further experiments are being done to determine the protective power of fabrics.

[This fascinating work is, of course, very important from the standpoint of defense against atomic bombs. Of particular interest were the findings that the skin burns produced in the period between 0.1 and 0.2 second after detonation were the most severe and that no burns were produced in experimental animals through the filter transmitting only ultraviolet light.—Ed.]

Determination of Tensile Strength of Healing Wound as Clinical Test. Ph. Sandblom, P. Petersen and A. Muren[6] (Univ. of Lund) measured the tensile strength of a test healing wound in 28 patients in an attempt to estimate the patient's healing power preoperatively. An apparatus (tensiometer) was constructed to establish the tensile strength of the wound. Every patient underwent two measurements in adjacent sections of a test wound 5 cm. long on the flexor surface of the forearm. Tensile strength was measured five days after the wound was inflicted. Values in the two determinations in each patient were similar although they differed from patient to patient. Further studies are being made with the tensiometer.

[This is an ingenious method of determining the tensile strength of a healing wound when there may be some fear of the potential healing ability of the wound.—Ed.]

Utilization of Sulfur Amino Acids during Healing of Experimental Wounds. Martin B. Williamson and Herbert J. Fromm[7] (Loyola Univ.) consider the utilization of cystine by regenerating wound tissue and its relation to the function measured by the healing index. The regeneration of tissue during the healing of wounds has been shown to be greatly accelerated by the addition of methionine to the diet. More recently, the rate of healing of experimental wounds was found to increase to the same extent when equivalent amounts of either cystine or methionine were administered

(6) Acta chir. scandinav. 105: 252-257, 1953.
(7) Proc. Soc. Exper. Biol. & Med. 83: 329-333, June, 1953.

Since conversion of methionine to cystine is irreversible in vivo, this work indicates that cystine is the limiting amino acid in the healing process

Two groups of rats were maintained on a 0% protein diet for five days before wounding After wounding, the 0% protein diet was supplemented with 60 mg dl alanine/100 Gm diet in one group and with 100 mg dl methionine/100 Gm diet in the other A circle of skin 3 cm in diameter was removed from the back of the neck down to the fascia Two days after wounding subcutaneous injections of 0 85 mg S^{35} labeled l methionine were made One third of the animals in each group was killed on the 5th, 8th and 12th day after wounding Samples of regenerating wound un wounded skin, liver and muscle were taken and analyzed for total sulfur, total nitrogen and cysteine plus cystine In addition to determining the total S^{35} in the samples, aliquots were partitioned into cysteine plus cystine and noncysteine plus cystine fractions and the S^{35} determined in the fractions

There was a marked increase in the S^{35} content in the regenerating wound even when the S^{35} content of the other tissues was decreasing The regenerating wound tissues accumulated cystine quite rapidly, whereas the concentration of methionine increased at a more leisurely rate In the liver and muscle there was a pronounced decrease in the methionine concentration but the cystine remained essentially unchanged. This might indicate that the liver and muscle methionine sulfur are the principal sources for the wound sulfur It would also follow that a large portion of the metabolized liver and muscle methionine is converted to cystine or cysteine, which may be utilized by the regenerating wound

The rate of healing (as measured by the healing index) is a function of the cystine content of the wound tissue

[This kind of work is very important if we hope ever to be able to hasten the healing of wounds. We must have a much greater knowledge of the fundamental factors involved. This means that we must know more about the chemistry of wound healing.—Ed.]

ANTIBIOTICS

Preoperative Preparation of Bowel with Neomycin in 50 patients is reported by John H. Davis, Ludwig R Kuhn, Joseph R. Shaffer and William H. Amspacher[8] (Brooks Army Med Center) *Half of them were given 1 Gm. every 4 hours orally for 24 hours before operation.* The other 25 received a single 4 Gm dose orally 24 hours before operation All patients were on a low residue diet and saline catharsis for three days before surgery Some received enemas when indicated

Neomycin effectively suppressed intestinal bacteria in most cases without evidence of development of resistant forms Results were better with the single dose of neomycin. Overgrowth of yeast or fungi was not evident. Toxicity from absorption of the drug did not occur Neomycin causes the stool to be liquid or semiliquid, thus aiding in elimination of solid material from the colon There was no evidence that bleeding, clotting and prothrombin times were prolonged by suppression of the intestinal bacteria.

Neomycin appears to be the most effective antibiotic available for intestinal preparation but it must stand the test of time as final proof of its effectiveness

Use of Erythromycin in Certain Surgical Infections Edwin J Pulaski and Sigmund A Wesolowski[9] (Walter Reed Gen'l Hosp) state that erythromycin is active in vitro against most gram positive cocci irrespective of whether they are sensitive or resistant to other antibiotics (except carbomycin) It overlaps penicillin in its antimicrobial spectrum The antibiotic originally available in capsules, is now mainly supplied in 100 mg enteric coated tablets for oral use, it can also be given intramuscularly or intravenously Once in the blood stream, the drug diffuses into ascitic and pleural fluids and through the placenta. The level in the cerebrospinal fluid is from $1/10$ to $1/4$ the serum concentration. Erythromycin is concentrated in the normal

(8) Surgery 35 434 439 March 19 4
(9) Surg Gynec. & Obst. 98 55-61 January 1954

liver and excreted into the biliary tree in active form About 15% of the administered dose is recovered in the urine Therapeutic concentrations can be detected in the prostatic secretions after ingestion of 500 mg Erythromycin is only partially absorbed from the gastrointestinal tract, and the unabsorbed drug has a suppressive effect on susceptible gram positive fecal organisms

Erythromycin was given to 60 adults with various infections It was used in many instances only after other antibiotics were ineffective and culture sensitivity tests revealed the causative organisms to be penicillin resistant All penicillin resistant, gram positive cocci were erythromycin sensitive

The usual dose was 400 mg every 6 hours, in capsule or tablet form, and total dosage varied from 4.8 to 96 Gm The drug was given for 4-42 days. Erythromycin concentration, determined in more than 50 different serums about two hours after ingestion, was over 0 3 μg /ml in 82% and over 1.2 μg /ml. in 64%

Of 26 patients with staphylococcic infection, 18 were benefited Failures were associated with emergence of drug resistant organisms or the nature of the lesion Of five patients with infections caused by streptococci or by streptococci and staphylococci, three showed a good response, one an equivocal response and one did not respond. Of 22 with genitourinary tract infections, 3 had excellent, 7 good and 3 equivocal results 9 did not respond Of seven patients with mixed infections caused by gram positive cocci and gram negative bacilli, one had a good response, three an equivocal response and three no response

Of the 60 patients treated, 53% were benefited, whereas 47% had an equivocal or no response Of the patients with staphylococcic infections, 70% were benefited Erythromycin was found to be beneficial when the causative organisms were erythromycin sensitive in early soft tissue infection, acute infections in bone with a good blood supply, septicemia, pericholangitis with adequate drainage of the biliary tree, acute prostatitis, acute epididymitis and staphylococcic enteritis The therapy was of little or no benefit in soft tissue infections caused by erythromycin resistant or

ganisms, mixed infections containing erythromycin resistant bacteria, infected wounds with unsequestrated necrotic tissue, late subacute bacterial endocarditis, chronic prostatitis and empyema.

The only untoward effects of erythromycin were gastrointestinal disturbances consisting of epigastric pain, nausea or mild diarrhea, which occurred in 21% of patients None were severe enough to warrant cessation of therapy Enteric coated tablets caused less reactions than gelatin-coated capsules.

A favorable response to erythromycin therapy is apparent within 72 hours of treatment, although treatment may be necessary longer With prolonged therapy, drug resistant forms may appear If no benefit is observed clinically by five days, continued therapy is likely to be useless Surgical intervention is necessary when necrotic foci are present.

Statistical and Clinical Analysis of Influence of Antibiotics on Incidence of Thromboembolism was made by H. W Friedrich[1] (Univ of Würzburg) Clotting and prothrombin times were determined and platelet counts made for (1) 48 patients postoperatively before, during and after treatment with antibiotics, (2) 22 patients not operated on but given antibiotics and (3) 20 controls not treated with antibiotics The antibiotics either had no effect on the blood values or caused variations similar to those in the control group Friedrich therefore believes it unlikely that antibiotics cause thromboembolic accidents This is borne out also by the statistical findings, as the number of patients with thromboembolic complications has not increased substantially since the introduction of antibiotics.

Antibiotics for Surgical Infections of Gastrointestinal Tract Edwin J Pulaski[2] (Walter Reed Gen'l Hosp) states that the understanding of host parasite and antibiotic parasite relationships and antibiotic host interactions is necessary for intelligent management of gastrointestinal infections Host parasite relations can be upset by (1) intestinal obstruction, (2) inflammation of the gallbladder pancreas and duodenum, (3) migration of the normal intestinal

(1) Arztl. Wchnschr 8 759 763 Aug 7 1953
(2) Surg., Gynec. & Obst. 97 353 360 September 1953

flora or their metabolites through the gastrointestinal tract which injures the liver and promotes hepatic necrosis, (4) increased permeability of the bowel wall such as occurs in uremia and shock, (5) damage of the bowel wall, (6) oral antibiotic therapy, and (7) ingestion of large numbers of pathogenic organisms with the production of specific infections such as amebiasis, dysentery or typhoid The antibiotic parasite interactions depend on sensitivity of the parasite to antibiotics Drug host interactions depend on the amount of antibiotic that reaches the infected area, route of administration, state of circulation, especially if shock is present, and variation in concentrations of the antibiotic in various organs such as the gallbladder and pancreas If the cystic duct is obstructed, antibiotics may not reach the gallbladder in sufficient concentrations to inhibit secondary invading organisms However, the drugs may afford protection against the infection and complications of acute cholecystitis Sulfadiazine, penicillin and perhaps streptomycin reach the pancreas, whereas other antibiotics do not

The use of antimicrobial agents against infections of the gastrointestinal tract may take one of three forms (1) suppression of fecal flora during critical periods, (2) prevention of infection following surgery, and (3) treatment of established infections

Suppression of fecal flora during critical periods includes the use of antibiotics in any condition which results in multiplication of bacteria within the liver or in which liver hypoxia or liver damage may be aggravated by bacterial products. The value of antibiotic therapy in acute cholecystitis is questionable Antibiotics are used in acute pancreatitis, perforated peptic ulcer and acute intestinal obstruction

Prevention of infection following surgery includes preoperative preparation of the bowel with cathartics, enemas and neomycin with or without sulfathalidine *

In perforated peptic ulcer and acute pancreatitis mixed therapy with penicillin (1,000,000 units) and streptomycin (1 Gm) given intravenously at 12 hour intervals may be used for prophylaxis against infectious complications Chlortetracycline or oxytetracycline (1 Gm) intravenously, with

or without concomitant oral administration of these drugs, appears useful for infections of the biliary tract due to susceptible organisms For intestinal obstruction or established acute secondary peritonitis, the aforementioned combination of penicillin and streptomycin, or chlortetracycline or oxytetracycline used singly, may be effective

New Aureomycin Dressing Rationale and Use in Treatment of Surface Wounds Joseph A. Tamerin, William I. Metzger and Louis T Wright[3] (Harlem Hosp., New York City), studied results of the use of over 2,000 new aureomycin (chlortetracycline) dressings in the treatment of such surface wounds as burns, skin graft donor and recipient areas, avulsions, abrasions and ulcers The chlortetracycline dressing (8×12 in.) is 44×36 mesh sterile surgical gauze impregnated with a base of bland hydrocarbon oils, cholesterol esters and a creaming agent containing a dispersion of micropulverized chlortetracycline hydrochloride (320 mg /dressing) Chlortetracycline can be used locally because it is nonsensitizing, has a broad antibacterial spectrum, is relatively stable in appropriate vehicles, controls dermatoses that occur at wound edges and is not destroyed by bacterial enzymes, does not interfere with or irritate wound healing and epithelization, and because resistance to the drug is relatively uncommon.

Bacteriologic study of 376 cultures from 77 patients—65 with burns and 12 with ulcers—disclosed only 4 patients with no contamination in the first cultures In 65% of the patients the first cultures were contaminated with one or more of the following potentially pathogenic organisms alpha hemolytic streptococcus hemolytic or nonhemolytic Staphylococcus aureus, beta hemolytic streptococcus, microaerophilic staphylococcus Escherichia coli, Aerobacter aerogenes, paracolon bacillus and Clostridium sporogenes. Among the 33 patients so contaminated bacteriologic follow up disclosed complete elimination of the organisms in 45% during treatment with the chlortetracycline dressing There were no untoward reactions nor interference with wound healing after the use of these dressings The wound healed with unusual speed under the chlortetracycline dress

(3) Am. J Surg 86 325-330 September 1953

ing, as might be expected when infection is controlled and when there is no chemical effect to retard epithelization Skin graft donor sites unavoidably contaminated by adjacent burn wounds also healed rapidly under the dressing The chlortetracycline dressing is convenient, readily available and affords an extra safeguard against the development of infection which, despite the best possible aseptic technics, always threatens

Clinical Significance of Increasing Resistance of Organisms to Antibiotics According to Frank L Meleney and Balbina A. Johnson[4] (Columbia Univ), the more often and the more indiscriminately any antibiotic is used, the more readily will bacteria of all types develop resistance and their progeny, propagating that resistance, fail to respond to treatment with the antibiotic No clinician, however experienced, can foretell whether the organisms of any given infection are going to respond to treatment with any of the antibiotics, unless he establishes the susceptibility of that organism to antibiotics in the bacteriology laboratory

The filter paper disk method is best for the evaluation of bacterial sensitivity By this method either the specimen of exudate itself or a small amount of broth in which the specimen has been suspended is smeared evenly over the surface of a blood agar plate Disks saturated with an antibiotic are placed on the surface of the agar after inoculation. After overnight incubation some indication of the sensitivity of the organism can be clearly shown provided there is sufficient growth to cover the plate The filter paper disks, ½ in. in diameter, absorb 0 1 cc The concentrations of the antibiotics are 10 units of penicillin, 40 units of bacitracin, 100 μg oxytetracycline and 250 μg each of neomycin and streptomycin. If the culture is susceptible to any of these drugs, that is the drug indicated for the treatment. If it is susceptible to two or more of the agents, one may be selected or two or more may be combined in the treatment. If there is a mixture of organisms in the culture, as is so often true in surgical infections, two antibiotics may be needed. If the culture is resistant to all of the tested antibiotics on the primary test secondary tests should be

(4) Surg., Gynec. & Obst. 97 26 76 September 1953

made with chlortetracycline, chloramphenicol, polymyxin and erythromycin If the micro-organism is resistant on the plate to all of these antibiotics, the inhibiting concentrations for each may be established by dilutions ranging from 100 to 250 units or micrograms downward in fluid mediums Often, a synergism between two or more of the antibiotics may be demonstrated, whereby fractions such as $\frac{1}{5}$ or $\frac{1}{10}$ of the minimal inhibiting concentration, when combined, will inhibit the growth of the organism This is often true when penicillin, bacitracin or streptomycin are combined, but it must be remembered that chlortetracycline, chloramphenicol or oxytetracycline may be antagonistic to the other three antibiotics

---

NEOPLASMS

Control of Cancer Mortality According to N E McKinnon[5] (Univ of Toronto), the age specific breast cancer mortality rates in Ontario show no declines but hold persistent levels despite an expanding program for control and many other factors conducive to earlier treatment The mortality in the Canadian provinces, Massachusetts, England and Wales is practically identical despite differences in cancer detection programs The failure of early treatment is thus established. Since failure of early treatment is due to later development of remote metastases from earlier spread of cancer cells, it must be postulated that in most cases of lethal breast cancer remote spread takes place through the blood stream before treatment can be instituted and that consequently neither early nor extensive treatment of the primary lesion can effect any material reduction in mortality

The limitations of histologic study are such that it is impossible to differentiate remotely metastasizing, locally metastasizing and nonmetastasizing types or lethal and nonlethal types consequently comparability of two or more series cannot be assured and a difference in survivals can

---

(5) Lancet 1 251 254 Jan. 30 1954

not be confidently attributed to difference in either time or type of treatment Stage 1 cancer (without axillary in volvement) includes cancer of all durations and tumors suspected of lacking potentiality for axillary or remote lethal involvement. Therefore, survivals in stage 1 cancer cases are not reliable evidence of survivals in lethal cancer treated chronologically early or in an early stage of develop ment As decreasing five year survivals are found in un treated cancers of consecutive duration, a decrease in sur vivals in treated cancers with increasing pretreatment dura tions cannot be attributed to delay in treatment Thus none of the evidence purporting to show superiority of early or different treatment of breast cancer is conclusive On the other hand, critical clinical and pathologic studies have shown that the type of cancer determines the outcome. The hypothesis based on the findings in vital statistics is there fore unopposed by any conclusive evidence but is supported by critical studies from other fields

As the development of metastases, after their implanta tion, appears to be independent of the primary lesion, there is no logical basis for assuming that successful treatment of the primary lesion with its lymphatics can materially postpone death.

The very early remote spread explains, as no alternative does, the similarity in survivals obtained with different treatments, and, along with the limitations of histologic examination, explains the inconsistencies and contradictions found throughout breast cancer literature Present evidence does not provide any encouragement that effectual control of mortality from any major cancer has yet been achieved This does not mean that cancer or tumor of any type should not be treated It does mean that investigation and treat ment should be tempered with an understanding of the lim itations of both diagnosis and treatment and that claims, even more than objectives, should be kept within the possi bilities of performance

[The general philosophy expressed here which would seem to imply that no great improvement in the over-all mortality of cancer of the breast is to be expected from earlier operations, is not new As long ago as 1932 (Ann. Surg. 95:336, 1932) Lewis and Rienhoff came to practically the same con clusion. Many others also have arrived at similar conclusions (MacDonald

Surg., Gynec. & Obst. 92 443, 1951 Smithers, Lancet 2 495, 1952, and this YEAR BOOK, pp 96 and 97) McKinnon does not claim any originality for his views and, indeed, he has a bibliography which will seem surprisingly long to those who think earlier diagnosis would be almost a solution to the cancer problem.—Ed.]

Malignant Cachexia. Hugh Donovan[6] (Birmingham) points out that although some authorities doubt the existence of a constitutional effect of malignant disease other than that due to hemorrhage, infection, mechanical pressure, etc., the clinical picture of malignant cachexia is clearcut, with recovery in certain circumstances on removal of the primary growth. The cardiac and alimentary musculature and the blood forming organs are most seriously affected

In the study of malignant disease, three problems remain to be solved (1) the cellular chemical changes that take place to make the cell malignant (2) the explanation of the other new properties of the cell, e g, the ability to produce metastasis, and (3) why the growth kills the patient.

The clinical picture of malignant cachexia is one of general constitutional effect throughout the body Greenstein has noted that the most striking effect produced in animals by malignant tumors is in the liver In rats with a wide variety of subcutaneously implanted tumors the levels of activity of one of the hepatic enzymes associated with oxidation, called catalase and also of arginase usually are below normal Removal of the growth leads to return of the normal enzymatic pattern Experimental evidence seems to indicate that widespread constitutional effects of malignant growths, possibly on the enzyme systems which influence cellular oxidation or release of energy within the cell, may particularly affect the musculature so that finally a critical degree of heart failure is reached and the heart stops

Toxicity of the medium bathing a tissue culture of malignant cells on a culture of normal cells should be investigated. The evident effect on energy production and the intractable anemia in malignant cachexia are two hints for future study which may be linked by Greenstein's suggestion that there is a defect in the metabolism of the iron porphyrins

(6) Proc. Roy Soc. Med. 47 27 32 January 1954

Certain malignant growths give off abnormal substances into the blood stream, as illustrated by the increased serum acid phosphatase in cancer of the prostate, Bence Jones proteinuria in myelomatosis, excretion of melanin in some melanotic growths and temperature disturbances in tumors of the kidney, probably due to some pyrogen in the circulation These effects are not manifestations of cachexia but examples of constitutional effects produced by a localized growth It is of practical importance to determine whether or not a constitutional effect is produced through the blood by a growth. If it is, one might hope to counteract it by medical means and thus prolong the patient's life, even if he cannot be cured

[Very interesting suggestions which should be investigated.—Ed.]

Observations on Use of Cortisone and ACTH in Management of Terminal Malignancy were made by Adolph P Raab and Alexander Gerber[7] (Jewish Hosp., Brooklyn) The mental and physical anguish which accompanies incurable malignant disease may be so severe that only opiates provide any measure of relief. The appetite fails and nutritional deficiencies result Depressive states are common and often the patient becomes aware of the true nature of his disease The psychic effects of cortisone and corticotropin (ACTH)—the feeling of well being increased self confidence, elation and optimism—have helped so much in the care of patients dying of malignant disease that their use is advocated The usual contraindications to the use of cortisone and corticotropin can be disregarded in terminal malignant disease The authors gave cortisone orally starting with 300 mg the first day, 200 mg the second day and 100 mg daily thereafter without interruption to a group of patients with various incurable malignant diseases The oral route was used except when there was persistent vomiting or oral feeding could not be immediately used. In such cases cortisone was given intramuscularly or corticotropin parenterally until oral therapy was feasible The results on the whole have been good. Cortisone and corticotropin have enabled the patient with a hopeless neoplasm to maintain a more normal existence for a longer time

(7) New York J Med. 53:1333 1334 June 1 1953

Salivary Gland Tumors Review of 121 Cases M. V Sirsat[8] (Bombay, India) clarifies these tumors as (1) mixed, (2) adenolymphoma, or papillary cystadenoma lymphomatosum, (3) mucoepidermoid, (4) cylindroma, and (5) carcinoma.

The mixed tumors (68 of the 121 cases) are regarded as adenomas Only 1 2% undergo malignant change There is a tendency to recurrence because of incomplete extirpation and satellite foci growing after removal of an encapsulated tumor The literature indicates equal division between sexes In this series, most tumors occurred in patients 20-50 The parotid gland contained 70% and the submaxillary 10% of these tumors

Adenolymphoma or papillary cystadenoma lymphomatosum was encountered three times, all in the parotid This tumor is benign and recurrence is unusual.

There were 13 cases of mucoepidermoid tumors, 7 benign and 6 malignant The benign form was characterized by ductlike and papillary processes lined by mucin containing columnar epithelium and foci of epidermal cells separated by edematous strands of connective tissue and mononuclear cell exudate The malignant tumors had scanty stroma and intracellular mucus with prominent squamous features and numerous mitotic figures The benign tumors were clinically indistinguishable from mixed tumors Four of the malignant tumors metastasized to cervical nodes, with facial paralysis in two

Cylindromas were seen in seven males and eight females. The commonest symptom was swelling with pain in five and facial paralysis in one Perineural lymphatics were infiltrated in three cases

There were 22 carcinomas, 19 in the parotid and 3 in the submaxillary gland Outstanding features were extensive local growth and invasion of adjacent structures Metastasis to lymph nodes occurred in 11 to the lungs in 2 and to skull and vertebrae in 1

Prognosis and treatment depend on the pathology In most salivary tumors surgical excision is the treatment of choice The slow growing mucoepidermoid tumors possess

(8) Indian J Surg 15 65 73 June 1953

invasive potentialities, and the malignant ones do not differ from carcinomas in clinical course and therapy. The clinical evolution of cylindromas is slow, Rawson *et al* reporting a 36% mortality rate over a period of 8-23 years. Radical procedures including removal of enlarged lymph nodes are indicated in operable carcinoma of the salivary gland, followed by irradiation.

Carcinoid Tumors: Clinical and Pathologic Study of 27 Cases. Rudolph G. Mrazek, Jr., Melvin C. Godwin and John Mohardt[9] (Northwestern Univ.) define carcinoid tumors as primary neoplasms which may occur at any point of the gastrointestinal tract from the cardia to the rectum. Among 27 patients studied, the tumors were duodenal in 3, ileal in 4, in Meckel's diverticulum in 2, cecal in 3, rectal in 9 and appendical in 5; in 1 the primary site could not be established.

Carcinoid tumor of the duodenum is usually asymptomatic and found incidentally during x-ray study of the stomach or gallbladder. It has a pronounced malignant potential which seems to correlate with the microscopic appearance. Two patients with tumors that appeared malignant histopathologically died of carcinoid tumor. The treatment of choice is local resection of the tumor with a cuff of normal tissue. One patient so treated had no evidence of recurrence after 21 months. Of the four ileal carcinoid tumors, two were solitary and two multiple. The carcinoid cells had invaded the muscularis in three cases, in two of which the tumors had also invaded through the serosa of the intestine causing incipient obstruction. No evidence of distant metastasis was found. Microsection of all four lesions revealed cells uniform in size and shape and a rarity of mitotic figures. Two patients had been well 10 and 12 years and one for 6 months postoperatively. The carcinoid tumor in Meckel's diverticulum was removed surgically in one case and was an incidental autopsy finding in the other. All three cecal carcinoids had metastasized widely and average survival was only eight months. The tumors, microscopically and clinically, appeared malignant and little if any benefit was derived from ileotransverse colostomy or x-radiation.

(9) Surg., Gynec. & Obst. 96:661-6, June 1953.

The operation of choice is therefore a right hemicolectomy Of the nine rectal carcinoids studied, only two were malig nant, they recurred, metastasized and killed the patients.

The malignancy of rectal tumors appeared to be cor related with size Tumors more than 2 cm. in diameter metastasized Radical excision of such tumors is advocated and the Miles operation is preferred The authors believe that all rectal carcinoids, regardless of size, have a malig nant potential, that the formation of metastases is only a matter of time and that tumors less than 1 2 cm. in diameter should be excised locally

Of five appendical carcinoids, two were found at appen dectomy for acute appendicitis and three were incidental findings Although all five patients had a benign course, appendical carcinoids are also potentially capable of metas tasizing

All carcinoid tumors are grossly and microscopically sim ilar They arise from cells of the glands of Liberkühn and may assume a variety of histologic patterns, all of which may appear in the same tumor The pattern is usually one of cords, strands and solid nests of cells, or there may be a palisade type of growth of distinctly columnar cells which may show a definite orientation. The palisaded strands may interconnect to form a reticular pattern. The cell cords often form pseudoglandular structures, and definite glandu lar acinar formations are often numerous even in distant metastases. The cytoplasm of carcinoid cells typically con tains numerous eosinophilic granules Grossly yellow tu mors contain cells with well developed granularity, whereas in white or gray tumors the granularity is not prominent. The color of the tumors ranges from grayish white to yel low and reflects the content of such lipids as cholesterol and lecithin.

Carcinoid tumors characteristically tend to enter lym phatic channels early and expand them by their growth but to metastasize slowly to regional nodes The smallest car cinoid tumor examined by the authors was almost undetect able grossly, had benign cellular characteristics, yet had already penetrated the muscularis of the appendix and

filled several lymph channels Many other small carcinoids penetrated the muscularis, yet only one (less than 0 5 cm. in diameter) had a malignant cellular pattern and had metastasized A small primary carcinoid may, nevertheless, be a source of widespread metastases In general, although small tumors tend to be benign and large ones malignant with distant metastases, every carcinoid tumor must be regarded as a neoplasm of potential malignancy

Malignancy is determined histopathologically by the criteria applied to other types of carcinoma cellular size, pleomorphism, frequent mitoses and invasiveness. Extension into the muscularis and to the serosa is a definite indication of malignancy even though individual cells may be uniform and well differentiated.

The usual pattern of metastases is involvement of regional lymph nodes followed by liver metastases by way of the portal system. However, as the tumor enlarges, the primary lesion or metastases may seed the peritoneum extensively The systemic vascular tree may be invaded and tumor cells may fill the larger venous channels Perineural invasion may also occur

The tumors in this series were nodular or pedicled Multiple carcinoids, present in four cases, all appeared to be multiple primary tumors rather than metastases In two of the four cases, both rectal and distant metastases were present. In three cases the carcinoids were associated with other carcinomas of the large bowel or rectum. Carcinoids tend to become fatal more slowly than other gastrointestinal carcinomas. None of the patients whose growths were still localized died of carcinoid tumor or had recurrences after adequate surgery Of eight patients with evidence of metastases, six died of carcinoid tumor an average 27 5 months after diagnosis, one, although still alive 15 months after abdominoperineal resection, had hepatic metastases, and one was lost to follow up

The treatment of choice for carcinoid tumors is adequate surgical excision based on the sound premise of removal of the primary tumor an adjacent zone of normal tissue and the primary lymph draining region

**Histogenesis and Clinicopathologic Correlation of N(
and Malignant Melanomas Current Status** Arthur C All
and Sophie Spitz[1] (Memorial Cancer Center, New Yo
City) classify as benign the junctional, compound, inti
dermal and blue nevi and juvenile melanoma, and as mali
nant the melanocarcinoma (deep and superficial) and mali
nant blue nevus In a study of 934 cases of maligna
melanoma, histologic slides of the primary tumor and ad
quate follow up data were available in 337

Though the junctional nevus is considered the foreru
ner of all malignant melanomas, only a small percenta
undergo malignant change It is, however, wise to remo
all nevi on the palms, soles and genitalia, preferably befo
puberty, as nearly all are junctional nevi Though ha
growing from a mole indicates an intradermal nevus ar
lack of elevation indicates a junctional nevus, histolog
examination is the only certain diagnostic means Althoug
most lesions believed to be malignant blue nevi are in r
ality something else, there are a few cases of maligna
transformation of blue nevi.

Approximately two thirds of juvenile melanomas may b
diagnosed on the basis of histologic features, the remai
ing third are histologically indistinguishable from adu
melanocarcinomas In the latter cases, the prepuberal ag
of the patient dictates the diagnosis of juvenile melanom
In a few isolated instances true, potentially metastasizin
or fatal melanocarcinomas occur in children. The autho
believe that juvenile melanomas are no more or less likel
to become melanocarcinomatous than other compound nev
Some adults may retain the histologic landmarks of ju
venile melanomas

Lesions of greater depth, size ulceration pleomorphism
of cells and mitotic figures are linked with higher fatalit
rates than lesions in which these features were less promi
nent Of the 337 patients with malignant melanoma (38 8%
women and 18 2% men survived Of those with lesions o
the head and neck, 57.5% of women survived compare
with 23 3% of men The worst prognosis of all is yielded b
melanocarcinomas of the mucous membrane of the head an

(1) A.M.A. Arch Dermat. & Syph. 69 150 171 February 1954

neck region and of the genitalia and anorectal regions

In 3 6% of the patients there were multiple primary melanocarcinomas. In patients with melanocarcinomas there seems to be a diathesis for the development of junctional nevi with activation leading to multiple melanocarcinomas This tendency accounts in some measure for so-called "local recurrences" Approximately 10% of melanocarcinomas are of the superficial variety with survival rate of about 74% Epithelial overgrowth plays a part in growth of malignant melanoma in that pseudoepitheliomatous foci, as they undergo junctional changes at their margins are a source of melanomatous cells

Although local excision has effected cure in a surprisingly great number of cases, over-all evaluation indicates that prophylactic regional node dissection with adequate excision of the primary lesion is preferable Prognosis is poor with local recurrences or lymph node metastases, but survival is not precluded. Survival for five years is not tantamount to cure

The authors favor the theory of the epithelial origin of nevi and melanocarcinoma, believing that the pigmented cells of the epidermis are merely altered epidermal cells The inherent capacity of individual epithelial cells to become melanoblasts is evidence of their participation in formation of nevi and melanocarcinomas

Malignant Melanoma Appraisal of the Disease and Analysis of 105 Cases Herbert Willy Meyer and Stephen L. Gumport[2] (New York Univ) state that malignant melanoma is a vicious tumor which is more common than generally believed, therefore suspicion of its existence must be constantly kept in mind. It is comparatively rare in Negroes The melanoma frequently develops in a junction type nevus and, in the early stage, may occur in only one portion of this nevus. Danger signs are any activity such as deepening in color, pain, infection or bleeding The malignant cells spread by direct extension, by way of the superficial and deep lymphatics and frequently through the blood stream. Diagnosis should be by total excision biopsy only *The tumor itself should not be cut into* Aspiration biopsy of an

(2) Ann. Surg. 138 643-660 October 1953

enlarged lymph node is likely to implant tumor cells along the needle track or miss the diagnosis

Surgery is the only method of treatment. Electrodesiccation, coagulation and all other lesser methods are dangerous The question of how radical surgery should be is still open to debate Radical surgery is certainly indicated. Whether ultraradical surgery, as quarterectomy, is advisable has not been decided Later survival statistics will show whether these mutilating procedures are indicated.

Melanomas of the eye are extremely malignant and may recur many years after the original operation Radical treatment for melanoma of the finger is amputation with later epitrochlear and axillary lymph node dissection. If the lesion is on the toe, amputation with later femoral, inguinal and deep iliac lymph node dissection is indicated. Rectosigmoid and anal melanomas are rare Treatment is radical abdominoperineal excision, followed by bilateral groin and deep iliac lymph node dissection Prognosis is grave if pregnancy is a complicating factor In juvenile and prepuberal melanoma, metastases are rare, and conservative surgery can be used

Of the 105 patients seen during 1944-52, most were aged 30-59 Over all five year survival rate of 65 cases seen between 1944 and 1948 was 41 5% When lymph node dissection was performed, the over all five year survival rate was 52.2% When the nodes were involved, the five year survival rate was 33 4%, when not involved, 66 7% Lymph node metastases make the prognosis much more serious. Cervical metastases are most favorable, axillary next, and groin metastases are most serious Early regional lymph node dissection should be performed, even if the lymph nodes are not clinically palpable

Management of Serious Scalp Injuries Control of infection and restoration of an acceptable cosmetic appearance are two factors of paramount importance, according to







Fig. 6 (above left) — Preoperative photograph showing area of scalp loss, denuded cranium cheek abrasion and partial ear avulsion.
Fig. 7 (above) —Immediate postoperative lateral view showing Z-plasty of left temple area at hairline and definitive repair of helix.
Fig. 8 (left).—Healed skin graft two weeks postoperatively
(Courtesy of Beers, M. D., and Pirruccello F W: Postgrad. Med. 14 487 493 December 1953)

Morrison D Beers and Frank W Pirruccello[3] (Chicago) They report on two girls whose heads were scraped along a cement paved road when the convertible in which they were riding overturned

Girl 16 had a scalp loss 8.5 × 7.5 cm. (Fig 6) She had not been

(3) Postgrad. Med. 14 48 -493 December 1953

unconscious and there was no skull fracture. Preoperatively she was given combined tetanus and gas gangrene antitoxin, penicillin and light sedation Seven hours after injury, under thiopental-curare and endotracheal nitrous oxide-oxygen anesthesia, the scalp and avulsed area were prepared and irrigated thoroughly The pericranium had been partially abraded and there were grooves on the outer table without penetration of the diploic space. The wound edges were debrided and a Gillies rotation flap advanced from the left parietal region into the defect. A Z-plasty was performed in the lower left temple area to relieve tension (Fig 7) A skin graft



Fig 9 (left) —Definitive result at eight months. Protruding ears have been corrected.

Fig 10 (right) —After removal of skin graft by multiple excision, to provide complete continuity of hair-bearing scalp.

(Courtesy of Beers, M. D., and Pirruccello F W Postgrad. Med. 14 487-493 December 1953)

was placed over the intact pericranium of the defect resulting from the rotation flap and held in place by a tie-on pressure dressing Lacerations of the ear were sutured and a petrolatum pressure dressing was applied. She was given 1,500 cc. whole blood during the operation. Convalescence was uneventful Figure 8 shows the healed scalp and graft after two weeks The skin graft was removed in three stages to provide continuity of hair-bearing scalp, and a bilateral otoplasty was performed to correct protruding ears which she had before the accident. Figures 9 and 10 show the patient at eight months.

The rich blood supply in the scalp promotes healing and allows shifting of large pedicles and rotation flaps Infection is relatively rare

Principles to be observed in closing scalp wounds are (1) wound closure with minimum tension, (2) covering of cranial defects with full thickness scalp without suture line overlying the defect, and (3) immediate covering of denuded bone and/or pericranium Basic aims in closing scalp defects are (1) scalp advancement, (2) relaxing incisions, (3) rotation flaps, and (4) application of free skin grafts

Rare bone cannot be covered successfully with split-skin grafts, however, when the outer table of cranial bone is thinned and perforated in multiple areas, there is a reasonable chance that the split skin graft will take Failures with pedicle grafts are due primarily to disturbances in vascularity from interruption of the main vascular channel, infection with resulting thrombosis and inept or excessively tight pressure dressings

---

FACE AND BUCCAL CAVITY

Sialolithiasis E Husted[4] (Rigshosp, Copenhagen) presents the clinical picture and treatment of 37 males and 26 females Calculi were found in the submaxillary gland 60 times and 3 times in the parotid In 47 cases they were in the duct, and in 1 case in both duct and gland. The clinical picture is due partly to the presence of the foreign body and associated retention phenomena and partly to infection in the oral cavity or the gland Ten patients had serious or extensive infection. In three, symptoms had persisted for 10 years Typical salivary colic was complained of by 38 patients periodic swelling while eating by 5

Diagnosis is verified by direct, bimanual palpation, probing or x ray If x rays fail to reveal the calculi, sialography may be used. Shadows of displaced tooth roots are sometimes misinterpreted as calculi

Treatment consists of removal of the concretion If situated in the submaxillary gland, as a rule removal of the gland with the calculus is indicated. Retention phenomena

(4) Acta chir scandinav 105 161 171 1953

of some duration with secondary infection also frequently indicate removal of the gland Spontaneous discharge of the calculus occurred twice Incision in the parotid with removal of stone was performed three times Sialodocholithotomy on Wharton's duct was done 36 times, with subsequent excision of the gland in 3 cases and primary excision of the gland in 15 Two patients who refused operation were followed three and eight years Symptoms subsided after one year, on follow up, the glands were slightly enlarged, hard and indolent The stones were still visible on x rays

If uncomplicated, concretions in the duct can be removed under regional anesthesia Excision of the gland is done under general anesthesia

Chemical analyses of the stones and saliva, as well as histologic and bacteriologic examinations, were performed. Roentgen crystallography revealed β tricalcium phosphate in 14 of 26 stones Analyses of saliva in seven patients afforded no basis for conclusions regarding stone formation. Histologic examination of 16 submaxillary glands showed pronounced nonspecific chronic inflammatory changes. No gland displayed signs of actinomycosis Bacteriologic examinations were carried out in four cases with a special view to demonstration of actinomyces, but none were found

Excisional Treatment of Cancer of Face William P Kleitsch[5] (Creighton Univ) believes that skin cancers, especially those appearing on the face are not best treated by x ray therapy As it is fair to assume that persons who have cancer of the face possess a facial skin which is predisposed to malignant degeneration it seems poor judgment to treat lesions of a cancer forming skin with an agent which is notoriously carcinogenic even for normal skins. In most instances, surgical excision of skin cancers of the face is desirable because of expedience, since it provides accurate histologic diagnosis and treatment in one procedure Surgical excision of skin cancers is preferable to radiotherapy because of superior cosmetic results. Recurrences of skin cancer are more simply treated when they follow excision rather than radiation treatment

(5) Mil. Surgeon 113 12 17 July 1953

TECHNIC.—The first phase of the operative treatment is devoted solely to total excision of the tumor—no consideration is given to reconstructive problems in this phase The skin is placed under moderate tension and the lesion circumscribed with a sharp scalpel

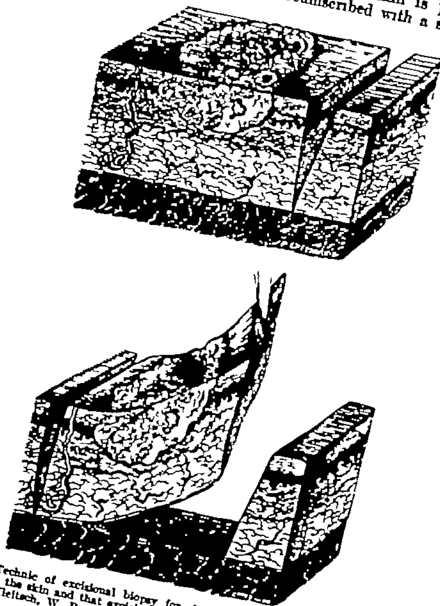


Fig 11.—Technic of excisional biopsy for skin cancers. Note that incision is at right angles to the skin and that excision includes the fascia of the underlying muscle (Courtesy of Kleitsch, W P Mil. Surgeon 113 12 17 July 1953)

at a distance of 3-5 mm. from its edge. Care is taken that the inci sion is vertical so that undercutting of the tumor is avoided. The incision is carried down to the fascia covering the underlying muscle, and this is removed with the specimen in one block (Fig 11) Closure is accomplished by modifying the defect slightly or making appro-

priate incisions to permit formation of sliding grafts of the edges of the defect. By utilizing natural skin folds and the lines of Langer, one is able to obtain an all but invisible scar in most cases. Skin grafting is not needed except for the most massive excisions.

Contribution to Treatment of Big Progressive Hemangiomas of Face Grete Olsen[6] (Copenhagen) believes that x rays and radium are ineffective but that combined injection of sclerosing fluids and surgery is generally satisfactory Preoperative ligation of arteries is unnecessary Preoperatively Olsen injects 0 4-1 cc varex or varicoid into one or several spots at a time and repeats the procedure in different sites as often as four times at weekly intervals. At operation it is important that the skin incision expose the whole tumor and that extirpation proceed from the periphery inward. With a large tumor of the cheek, it may be advisable first to expose the facial nerve before it enters the tumor provided muscles innervated by the nerve can be left intact. A skin defect may be covered by a thin free skin graft if there is a soft tissue base, exposed bone requires a skin graft

Man, 27, had a congenital hemangioma racemosum of the left cheek which began to grow at age 10 Despite x ray therapy and attempts at removal at age 16 and multiple artery ligation at age 25, by age 27 the tumor had extended to the left lower lid, upper lip and into the mouth, so that biting caused serious bleeding and infection. Since the first operation there had been complete paralysis of the facial nerve. After four injections of varex the operation was performed. The old scar was excised and skin flaps were elevated around the tumor, which was excised in toto from the eyelid, lip and cheek. All soft tissue had to be excised, including parts of the parotid gland and the facial muscles (except the masseter) down to bone, and mucous membrane was removed where the tumor protruded into the mouth. The skin was sewn back after trimming Healing proceeded well. Enough soft tissue developed under the skin flaps after eight months to permit reconstruction. Excess of mucous membrane and skin was removed and two slings of fascia lata were inserted to elevate the left angle of the mouth. Final cosmetic results were good

(6) Acta chir scandinav 105 222 226 1953

Emergency Tracheotomy is defined by Walter B Hoover[7] as establishment of an airway by opening the trachea beyond the respiratory obstruction to relieve the suffocating patient. Emergency tracheotomy is indicated for severe respiratory obstruction when facilities for immediate intubation to relieve the obstruction are not available or when the patient's condition does not allow time for orderly surgical tracheotomy Signs and symptoms of obstruction include stridor and retraction of the suprasternal notch and the supraclavicular fossa and of the intercostal spaces, sternum and epigastrium in children and thin persons Restlessness, apprehension and inability to sleep are important early symptoms, the ashy grayness of cyanosis is a late symptom in the exhausted person

Acute laryngeal obstruction can result from accidents and such acts of violence as stabbing or gunshot wounds that lacerate and traumatize the larynx or upper trachea, causing edema and obstruction Impaction of a foreign body (a bolus of meat in eating or the aspiration of some article held in the mouth) may cause acute laryngeal obstruction Suffocating edema of the larynx may result from a bee sting on the throat, angioneurotic edema or rapidly progressive obstructive edema associated with infection True emergencies also arise among persons with chronically narrowed airways or gradually progressive laryngeal obstructions, as in bilateral paralysis of the recurrent laryngeal nerves or tumors of the larynx and trachea Operative procedures around the mouth, tongue, jaws, larynx, pharynx and neck and thyroid regions may lead to laryngeal or tracheal obstruction and prophylactic tracheotomy is advisable if respiratory obstruction is likely For relief of emergency respiratory obstruction, intubation is the method of choice, but if this is not possible, an emergency tracheotomy may be necessary

(7) S. Clin. North America 33 887 895 June 1953

TECHNIC.—With the patient supine and his neck extended, a pillow or pad is placed under the shoulders. The thyroid notch and the ring of cricoid cartilage are easily located by palpation. The thumb and second and third fingers of the left hand are arched over the larynx, and the soft tissues of the neck below the pharynx are pressed back on each side of the trachea, tightening the skin above the trachea below the cricoid ring. A bold, deep incision is made longitudinally in the midline from the cricoid ring down, quickly cutting through all the tissue and exposing the tracheal ring. The incision is extended through the tracheal rings, preferably below the first ring. The tracheal incision is kept open with forceps, knife handle or any kind of retractor available to produce a free airway. The patient is turned on his side to prevent blood from running into the tracheal opening, and a tracheal cannula is secured. Artificial respiration and oxygen if available are given until the normal respiratory cycle is resumed. Such an operation has been performed with nothing more than a pocket knife to save a life.

An orderly tracheotomy should be carried out before the obstruction creates an emergency, in which case it should be controlled by intratracheal intubation. Intubation is an essential part of the orderly tracheotomy as it guarantees a patent airway.

TECHNIC.—A median longitudinal incision is made below the prominence of the cricoid ring to the sternal notch if there has been no previous cervical operation and if there is no complicating thyroid tumor or other cervical disease. The tissues from the skin to the trachea are separated by blunt and sharp dissection, and the vessels are caught, cut and tied as necessary to control bleeding. The trachea is bared from the second tracheal ring down. The thyroid isthmus is separated from the anterior tracheal wall by introducing scissors or hemostatic forceps between the thyroid isthmus and the tracheal wall and parting the tips. Hemostatic clamps are placed on the thyroid isthmus. The isthmus is cut between clamps and tied. A circular section the size of the tracheotomy tube to be used is removed from the anterior tracheal wall in the midline, below the second tracheal ring. All bleeding is controlled. The anesthetist is instructed to withdraw the endotracheal tube until its end is just above the tracheal opening made by removing a circular section of the anterior tracheal wall. A tracheal cannula of appropriate size is then inserted. The lower end of the tracheal cannula lies free in the tracheal lumen and is parallel to the longitudinal axis of the trachea.

A transverse cervical or thyroid incision is used when the laryngeal or tracheal obstruction results from cancer or other tumors of the thyroid or cervical region and when pretracheal or other masses in the neck have to be excised. The thyroid incision may then be turned up or in any other direction necessary to complete the ex

posure. All necessary surgical procedures are then carried out in the neck and the trachea is prepared. A circular window is made in the anterior tracheal wall for the tracheotomy tube. The opening of the trachea should be low enough to permit the tracheotomy cannula to lie in the proper position without pressure from the upper flap of the wound. Should the upper flap press against the top of the tube, a second median line vertical incision large enough to accommodate the tube and prevent pressure and tipping downward of the outer portion of the cannula is made in the upper flap

Postoperatively, tracheal and bronchial secretions should be carefully removed through the tracheotomy tube. The secretions can be kept thin by an electric humidifier, steam inhalations, a damp gauze over the tracheotomy tube and instillation of normal saline or Ringer's solution into the tracheal cannula. Expectorants also help to thin secretions, and antibiotics are useful.

[Every doctor should know how to open the trachea and insert a tube. By the way the operation should be called tracheostomy rather than tracheotomy.—Ed.]

Thyroglossal Cysts and Sinuses are discussed by Samuel F Marshall[8] (Lahey Clinic) These anomalies have a congenital origin, a persistent thyroglossal duct. The cysts are often discovered during examination for tumors of the neck and comprise the most frequent pathologic anomaly of this congenital tract A sinus may result from spontaneous rupture of a thyroglossal cyst which has become inflamed and gone on to suppuration or from incomplete surgical removal of a thyroglossal cyst A cyst or sinus may occur at any level in the midline of the neck from the foramen caecum to the suprasternal notch. Most cysts are in close approximation to, or just below, the hyoid bone Of 388 patients seen at the clinic, 50% gave a definite history of inflammation before coming for treatment Lesions of the thyroglossal tract may occur at any age, and in this series there were more females than males

The commonest symptom of a cyst is a painless rounded swelling in the midline of the neck. A characteristic sign is elevation of the cyst with swallowing Surgical excision of cysts or sinus tracts with complete extirpation of the entire thyroglossal tract up to the foramen caecum is necessary to prevent recurrence The middle part of the hyoid

(8) S. Clin. North America 33 633-644 June 1953

bone must be removed Recurrence is rare if radical operation is done Malignancy of the thyroglossal tract is rarely encountered.

TECHNIC—The patient is placed in the thyroidectomy position with the neck extended, and a transverse incision, 6-8 cm. long, is made at the level of the hyoid bone and carried through the platysma muscle If a sinus tract is present a transverse elliptic incision is made about the sinus opening The sternohyoid muscles are separated in the midline and retracted, with exposure of the cyst or sinus tract. The cyst or tract is separated posteriorly from the thyrohyoid membrane up to the hyoid bone, which is cleared of muscle tissue. A central part of the hyoid bone, 1 cm. long, is divided by bone forceps and the fragment of the bone and cyst tract are elevated. A "coring out of tissue," as suggested by Sistrunk, is done to include a portion of the median raphe of the mylohyoid with a portion of the geniohyoid and genioglossus muscles up to the foramen caecum The tract above the hyoid bone is extremely tenuous and will rupture easily and may be difficult to identify The anesthetist can aid in dissection by putting a finger in the patient's mouth and elevating the tongue at the foramen caecum. The opening in the mouth can be closed with catgut. The ends of the hyoid bone can be approximated with suture in fascia or muscle attached to the bone.

Carotid Body Tumors Report of 12 Cases, Including 1 Case with Proved Visceral Dissemination H. Mason Morfit, Henry Swan and Ellis R Taylor[1] (Univ of Colorado) add reports on 2 males and 10 females, average age 50, to the 275 cases of carotid body tumor found in the literature The commonest complaint is of a lump in the neck. The diagnostic appraisal must encompass all possibilities that might explain the presence of such a neck mass If physical examination and aspiration biopsy fail to disclose the correct diagnosis, surgical exploration is necessary In most of the 12 patients, accurate diagnosis was established only on operation. The tumors were removed in all but one case, and in 8 of 11 resections, this was accomplished without interruption of the continuity of the arterial stream Three patients treated with ligation had no permanent sequelae No one died as a result of operative procedures, but follow up a few months to 14 years later disclosed one death due to local recurrence associated with distal dissemination of the

(1) A.M.A. Arch. Surg 67 104 214 August 1953

disease One patient with metastases to regional cervical nodes had had no further difficulty six years after local removal of the primary tumor combined with rather limited dissection of the grossly involved nodes None of the other patients had had a recurrence

Obviously, tumors of the carotid body are not totally benign, as has been claimed, and, if followed long enough, cause serious trouble either by local invasion of surrounding structures or by distant dissemination. Embryologic studies of the carotid body have shown that the structure arises in the adventitia of the carotid body and that this relationship is maintained in adult life The adventitia of large and medium sized arteries can be sacrificed without compromising the success of primary anastomosis or arterial homografts With reasonably early operation, tumors of the carotid body may be safely and completely removed without interrupting the continuity of the arterial stream provided the dissection is carried out in the plane of the arterial adventitia In the event that the lumen of the artery is inadvertently entered in the course of removal, one should never resort to ligation, because the method cannot be made safe for the patient regardless of what pre or postoperative adjunctive measures are taken. Restoration of continuity of the arterial stream by means of simple closure of the hole, primary end to-end anastomosis and insertion of an arterial homograft or venous autograft in that order are recommended as solutions to this complication.

Management of Carotid Body Tumors Case Report of Bilateral Carotid Body Tumors is presented by Arthur G James and Richard Saleeby[9] (Ohio State Univ)

Woman, 41, had swellings on both sides of the neck for approximately six years. A brother, aged 32, had similar tumors. The diameter of the mass on the right was 4 cm. and of that on the left 5 cm. Each was located in the region of the anterior cervical triangle deep to the sternocleidomastoid muscle, and each was movable laterally and fixed in the vertical plane. There was no bulging of the pharyngeal wall, no bruit or pulsation, and the tumor did not change in size on compression of the common carotid artery At the time of operation on the right side, a highly vascular tumor of the carotid body was found, adherent to the bifurcation of the common carotid, displacing the external carotid anteriorly and surrounding and dis

(9) Surgery 34 104 110 July 1953

placing the internal carotid posteriorly The tumor was removed by meticulous sharp dissection without sacrificing any vital structures. She was discharged and returned 10 months later for removal of the tumor on the left side of the neck (Fig 12) The vascular stroma and anatomic relationship were practically identical with those seen on the right There were no changes in any of the physiologic functions of the carotid body Grossly, the tumors had similar appearance (Figs 13 and 14), and microscopic diagnosis was carotid body tumor

This represents the only pathologic lesion of the carotid



Fig 12 —Tumor on right side removed. Note position of carotid body tumor (Courtesy of James, A. G and Saleeby R.: Surgery 34 104 110 July 1953)

body and is usually a unilateral, asymptomatic, slow but persistently growing mass in the region of the bifurcation of the common carotid artery A certain percentage will undergo malignant transformation Ideal treatment is excision without injury to any of the major vessels.

On exposure of the common carotid artery, a very characteristic reticulum (Figs. 15 and 16) is encountered, which continues up along the course of the common carotid ar



Fig. 13 (top).—Carotid body tumor.
Fig. 14 (bottom).—Tumor in cross-section.
(Courtesy of James, A. G. and Saleeby, R.: Surgery 34:104-110, July 1953.)





Fig. 15 (top) —Carotid body tumor dissected free from carotid bulb.
Fig 16 (bottom) —Diagrammatic sketch after carotid body tumor has been dissected free from carotid bulb. Note vascular meshwork along course of carotid artery (Courtesy of James, A. G and Saleeby R. Surgery 34 104 110 July 1953)

tery and becomes a part of the tumor This is a very fine and abundant vascular meshwork and appears to increase in caliber as it approaches the tumor This vascular phenomenon, which is diagnostic of carotid body tumor, appears to be a continuation of the vessels along the course of the common carotid artery

Relation between Internal Jugular Vein Pressure and Cerebrospinal Fluid Pressure in Operation of Radical Neck Dissection. Henry P Royster[2] (Univ of Pennsylvania) studied 32 patients who had undergone 34 unilateral or bilateral radical neck dissections, mostly for carcinoma. Studies included preoperative Queckenstedt tests, studies of internal jugular vein pressures before and after ligation and cerebrospinal fluid pressure before, during, and after operations Seven Queckenstedt tests were performed before operation, with one positive result In the anesthetized patients the average internal jugular vein pressure in 22 patients was 13 cm. in the right vein, and in 10 patients 17 cm in the left vein. After ligation of the internal jugular vein the average pressure in the right vein was 33 cm. and in the left vein 26 cm. Cerebrospinal fluid pressure in six patients was recorded continuously during operation, in five there was an immediate rise of pressure after ligation of the jugular vein. The increments ranged from 15 to 80 cm. Cerebrospinal fluid pressure the day after radical neck dissection was almost universally elevated.

The mechanical factors that participate in the maintenance and fluctuations of normal resting cerebrospinal fluid pressure are cerebral venous pressure, arterial pressure, respiratory action, volume and pressure of fluid in the skull and action of the vagus nerve When the jugular and adjacent cervical collateral veins are interrupted, intracerebral pressure rises. Because of the multiplicity of factors there is no constancy in their interaction, for there is no certainty that only one force is in operation. It must be emphasized that the increase of jugular vein and cerebral venous pressures after ligation of the internal jugular vein comprises only one of the mechanical factors in the rise of cerebrospinal fluid pressure Several conditions during

(2) Ann. Surg 137 826 32 June 1953

surgery participate in raising intracranial pressure anesthesia, straining and coughing of the patient, spasm of the veins above the clavicle, and possibly temporary blockage of cranial venous outflow due to reflex spasm in other non ligated veins in the neck, and anomalies of the sinuses of the brain.

The increase of jugular vein pressure after ligation is not a true gauge of increased intracranial pressure but may be suggestive when the increment over the preligation pressure exceeds 30 cm Ligation of one or both internal jugular veins may be followed by so great an increase in cerebrospinal fluid pressure that death may result. A few simple prophylactic precautionary measures can be used The Queckenstedt test preoperatively will show response to compression of the neck veins Variation from the expected normal will indicate the need for following cerebrospinal fluid changes during operation Lumbar punctures must precede operation so that continuous recordings of pressure in a manometer may be made When the pressure rises beyond the desired limit, fluid may be withdrawn and the pressure regulated as needed Attempts should be made to prevent arterial pressure from rising Postoperatively, lumbar puncture may be done at any time to lower cerebrospinal fluid pressure

Surgical Procedures for Relief of Symptoms of Paralysis of Recurrent Laryngeal Nerves Walter B Hoover[3] notes that bilateral paralysis occasionally occurs during thyroid operation by the most experienced surgeons Attempts at restoration of function of the recurrent laryngeal nerve by direct suture graft or anastomosis with other respiratory nerves have failed, but operative procedures have been devised to relieve symptoms produced by loss of function of the muscles supplied by the recurrent laryngeal nerves.

Impairment of the voice due to unilateral paralysis may not be great and may improve as the vocal cords compensate by approximating each other Lack of tension in the normal cord may cause voice impairment to persist, and those who rely on their voices in their occupations are handicapped.

(3) S Clin. North America 33 379 885 June 1953

Untreated bilateral paralysis leads to chronic invalidism, the resulting obstruction produces dyspnea and stridor of varying degrees and may lead to suffocation and death If recovery of function is considered hopeless, surgery to widen the glottis is indicated unless the patient prefers a tracheotomy tube Treatment is for relief of the laryngeal obstruction only

Surgical treatment of unilateral paralysis is for voice improvement only A piece of rib cartilage of proper size and shape is implanted beneath the wing of the thyroid cartilage, wedging the vocal cord toward the midline and the arytenoid cartilage posteriorly

King's extralaryngeal operation consists of freeing the arytenoid cartilage from its fellow on the opposite side by severing the interarytenoid muscle, disarticulation of the joint and fixation of the arytenoid with its attached vocal cord laterally by permanent suture to the ala of the thyroid cartilage This and the Kelly extralaryngeal arytenoidec tomy through a window in the thyroid cartilage have been replaced by extralaryngeal lateral transfixation of the vo cal cord with or without arytenoidectomy Most recently Thornell has described intralaryngeal arytenoidectomy

None of these methods is foolproof, but most are success ful in a high percentage of cases when carefully done The author advises against bilateral arytenoidectomy which permits collapse of the soft tissues over the glottis

---

THYROID AND PARATHYROID

Parathyroid Cysts Report of Five Cases George Crile, Jr., and R. G Perryman[4] (Cleveland Clinic) report that clinically significant parathyroid cysts are rare and usually do not have demonstrable endocrine function They are al most never recognized preoperatively but have easily recog nized gross characteristics at operation.

CASE 1—Woman 34, had a gradually enlarging nodule in the left side of the neck for one year Examination revealed what was thought to be adenoma of the left lobe of the thyroid and a cyst of

(4) Surgery 34 151 154 July 1953

the pyramidal lobe of the thyroid (probable thyroglossal duct cyst) At operation a small adenoma of the pyramidal lobe and a small clear watery cyst adjacent to the left lower lobe were found. Microscopic examination revealed that the wall was formed by dense collagenous tissue including a few elongated and vascular islands of small cuboidal cells with clear cytoplasm and uniform round nuclei. Pathologic report was cyst of congenital origin with small parathyroid rests in the wall. There was no evidence of hypoparathyroidism postoperatively

CASE 3—Woman, 69, who had had right radical mastectomy for carcinoma seven years previously, had hoarseness, respiratory distress and a mass in the right lower neck. There was paralysis of the right vocal cord. At operation a cyst of probable parathyroid origin was found extending from the right retrothyroid area into the right superior mediastinum, displacing but not involving the recurrent laryngeal nerve. In the wall of the cyst there were in one area groups of small parathyroid cells with clear cytoplasm.

There is a tendency for clinically significant parathyroid cysts to arise from the inferior parathyroid glands lateral to the thyroid, where they are easily dissected free from the gland.

Diagnosis of Morphologic Abnormalities of Human Thyroid Gland by Means of I^{131} Franz K. Bauer William E

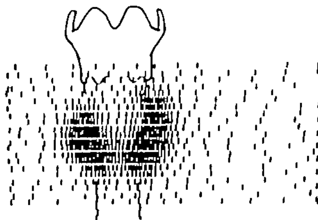


Fig 17—Scintigram of latex model of normal human thyroid gland. Trachea and larynx are sketched in. (Courtesy of Bauer F K. *et al.* Radiology 61:935-938 December 1953)

Goodwin, Raymond L Libby and Benedict Cassen[5] (Univ of California, Los Angeles) use a directional scintillation counter and I^{131} to obtain an outline or "scintigram" of the thyroid gland in normal and abnormal states

(5) Radiology 61:935-938 December 1953





Fig. 18 (top).—Toxic thyroid adenoma in patient with hyperthyroidism. Note suppression of I^{131} accumulation in remainder of thyroid gland.

Fig. 19 (bottom).—Same patient six weeks after right hemithyroidectomy. Note remaining thyroid tissue in right lobe and apparently normal function of entire left lobe.

(Courtesy of Bauer, F. K., *et al*: Radiology 61:935-938, December, 1953.)



Fig. 20.—Diffusely enlarged thyroid gland in patient with hyperthyroidism. (Courtesy of Bauer, F. K., *et al*: Radiology 61:935-938, December, 1953.)

METHOD.—Between 100 and 300 μc. carrier free I^{131} is given orally in capsule form, the exact dose depending on avidity of the thyroid for the isotope. About 24-48 hours later (24 hours is preferable in hyperthyroid patients) the scanning tube is run over the area where





Fig. 21 (top).—Nonfunctioning area in right lobe. Papillary carcinoma.
Fig. 22 (bottom).—Scintigram of patient with carcinoma of thyroid who had total thyroidectomy. Metastases were demonstrated only after thyrotropic hormone stimulation. Patient had been given 200 μc. I^{131} for a year before scintigram was taken. This eliminates possibility of remaining normal thyroid tissue.
(Courtesy of Bauer, F. K., *et al.*: Radiology 61:935-938, December, 1953.)

functioning thyroid tissue is thought to be. The scaling circuit can be adjusted so that the printing relay will record every 2d, 4th, 8th 16th, 32d and 64th count. The I^{131}-containing areas are recorded at 1 mm. centers with greater spacing over the areas not accumulating iodine (Fig. 17).

Toxic nodules appear as dense areas (Figs. 18 and 19),

whereas the remainder of the gland is often not apparent because of suppression of function. Diffusely enlarged glands (Fig 20) are outlined by this procedure to estimate correct weight of the gland. Shrinkage after I^{131} therapy can be observed The amount of remaining gland can be determined in patients with recurrent hyperthyroidism following partial thyroidectomy

Outlining is also used for simple goiter, including substernal extensions, solitary (Fig 21) or multiple nodules and aberrant thyroid tissue Only about one of seven carcinomas of the thyroid accumulates I^{131}, when one does, both primary lesions and metastases accumulating I^{131} can be demonstrated by the scintigram Thiouracil and thyroid-stimulating hormones have been used to enhance I^{131} accumulation in metastases (Fig 22)

Total Transplant of Thyroid Gland Using Vascular Anastomoses Report of Successful Result in Chronic Tetany Julian A. Sterling and Ralph Goldsmith[6] (Philadelphia) note that the human parathyroid gland up to age 10 contains the "chief" cell, the active secreting cell. Thus parathyroid tissue from a child is most desirable for transplant To avoid injury to the parathyroid, the tissue may be obtained as part of the intact thyroid gland.

Woman, 28, blood type AB Rh positive, had bilateral recurrent laryngeal nerve palsy, severe hypothyroidism and severe hypoparathyroidism following thyroidectomy 10 years before. Tetany had been progressively continuous, and 30-80 cc. calcium gluconate intravenously was required daily Transplantation of parathyroid tissue using tissue culture technic was unsuccessful. On calcium therapy the serum calcium content was 8.8 mg/100 ml, when not taking calcium, 5.2 mg

One hour after death of a 3 week old boy, under aseptic precautions the entire thyroid gland including its vascular pedicles was removed and perfused in Darrow's solution with 1 mg heparin/cc. The gland was less than 2 cm. in diameter and weighed 1.5 Gm. The graft was placed just above the patient's left inguinal ligament and anastomoses were made between the left carotid artery of the transplant and the superficial pudendal vein, left jugular vein and lateral segment of the superficial epigastric vein, right jugular vein and medial segment of the superficial epigastric vein and right carotid artery and superficial epigastric artery The implantation was completed six hours after death of the donor Intravenous cal

(6) Surgery 35 6 4-628 April, 1954

cium therapy was required for eight days until total protein level, which had dropped, was restored by intravenous plasma and protein feedings. All medication except oral administration of calcium was stopped. Radioactive iodine uptake indicated that the transplanted gland behaved as normal thyroid tissue. Normal activities were resumed Blood calcium, phosphorus and protein levels became normal. Symptoms of hypoparathyroidism and hypothyroidism were relieved and the patient was well 15 months after transplantation.

This patient's blood group permitted transplantation of tissue from a donor of any blood type It is believed that any effort to assure circulation to new tissue will assist in maintenance of viability for a longer time

[This very interesting case recalls the work of Harvey Stone 20 years ago and the disappointing results with the transplantation of parathyroid tissue. Perhaps Sterling and Goldsmith have achieved a startling result, but a period of 15 months after operation is hardly long enough to determine whether or not the graft will live indefinitely—Ed.]

Further Observations Regarding the Prognosis and Diagnosis in Hyperparathyroidism. John Hellström[7] (Karolinska Hosp) has studied 10 additional cases of hyperparathyroidism since the 21 reported in 1950 Prognosis in hyperparathyroidism depends largely on the renal damage induced by the disease Among 10 patients in whom hyperparathyroidism vanished after parathyroidectomy, after more than two years had elapsed postoperatively, hypertension or renal insufficiency was responsible for death in 4 and for severe invalidism in 3 others Another patient followed for less than one year died of renal disease and hypertension.

The best known and more striking findings typical of hyperparathyroidism are decalcification of the skeleton, usually in the form of generalized osteitis fibrosa cystica and renal concrement or calculus formation. Prognostically even more important are (1) renal damage probably involving the tubules in particular and reflected chiefly in decreasing power of concentration and (2) elevation of blood pressure, usually progressive No direct connection between renal damage and hypertension has been found in the earlier stages of the illness when blood pressure elevations vary greatly With the onset of secondary nephrosclerotic and pyelonephritic renal changes, more permanent hyper

(7) Acta chir scandinav 105 122 131 1953

tension determined more definitely by the state of the kidneys makes its appearance Since the prognosis after hyperparathyroidectomy depends on the renal damage that had occurred and on the severity of hypertension, early diagnosis and operation are of vital importance

The most important laboratory finding in hyperparathyroidism is an increase in blood calcium level, but it was not elevated in some cases Usually it is the diffusible portion of the serum calcium that is elevated in hyperparathyroidism. A reduction of plasma protein level may mask elevated serum calcium values Blood phosphorus level usually falls in hyperparathyroidism, but it depends largely on the condition of the kidneys and rises with severe renal damage Normal urinary calcium values by no means exclude the possibility of hyperparathyroidism. The Sulkowitch test for urinary calcium is not very useful. Phosphatase determinations are of relatively small importance in diagnosis The value of radiology lies particularly in its ability to reveal skeletal changes and urinary lithiasis, even though they are not in themselves pathognomonic Since serum calcium values may lie within normal limits, blood calcium levels should be measured repeatedly whenever hyperparathyroidism is suspected. It is possible to measure directly the free diffusible calcium fraction and elevation of this fraction is pathognomonic for hyperparathyroidism. Arteriography may be of value in topical diagnosis

A parathyroid adenoma may be included in the thyroid, and subtotal thyroidectomy before mediastinotomy is recommended if exploration of the neck fails to disclose parathyroid adenoma

rington[1] (Mayo Clinic), in a study of survival rates among 4,637 patients with unilateral carcinoma of the breast who had had radical mastectomy in 1910-34, was able to trace 4,563 (98 4%) Of these, 25 1% had lived 15 years or longer, 17 6% 20 years or longer, 12 6% 25 years or longer, 9 3% 30 years or longer and 6 9% 35-40 years after the operation. A second tabulation of survival rates was made to establish the influence of axillary node metastasis, found at time of operation, on the prognosis Of those with metastasis, 12% had lived 15 years or longer, 7.5% 20 years or longer, 4 7% 25 years or longer, 3 8% 30 years or longer and 2% 35-40 years Of those without metastasis 48.2% lived 15 years or longer, 36 4% 20 years or longer, 26 7% 25 years or longer, 19 1% 30 years or longer and 14% 35-40 years

Survival rates of all women who lived 15 years or longer after unilateral radical mastectomy for carcinoma of the breast and subsequently underwent radical mastectomy for carcinoma of the other breast termed bilateral nonsimultaneous carcinoma of the breast was made Among 4 753 patients there were 116 (2 44%) such patients. Of 114 patients traced 35 1% lived 15 or more years and 24 1% 20 or more years after the first radical mastectomy Of those who survived 15 years, 67 5% did not have nodal metastasis at the time of the first operation and 32 5% did Of those who survived 20 years, 55% did not have nodal metastasis at the time of the first operation and 45% did. Of 18 patients who survived 15 years or more 38 9% had nodal metastasis, and 61 1% did not Of nine patients who survived 20 years or longer 33 3% had nodal metastasis and 66 7% did not

The prognosis of carcinoma of the breast after radical mastectomy depends on (1) the extent of the malignant involvement at the time of operation (2) the degree of malignancy disclosed by microscopic examination of the primary lesion (3) the presence of other associated conditions such as pregnancy and lactation, (4) the presence of general constitutional diseases such as diabetes and (5) the age of the patient Most important of these is the extent of the disease at the time of operation as indicated by the presence or

(1) Ann. Surg. 137:843 849 June 1953

absence of axillary nodal metastasis found microscopically The prognosis is more favorable in patients whose axillary lymph nodes are not involved.

Staging and Prognosis in Breast Carcinoma Andrew J McQueeney[2] (Albuquerque, N M) proposed a scheme for classifying breast carcinoma to integrate histologic, gross, pathologic and clinical findings to produce a more realistic staging, useful in follow up and therapeutic evaluation studies Factors which influence prognosis in breast carcinoma are histologic structure, axillary metastatic level, extra axillary spread, associated pregnancy or lactation, subepidermal lymphatic or vascular permeation with or without inflammatory carcinoma, location within the breast and size of primary tumor

In stage I, the primary lesion is limited to the breast without demonstrable extramammary extension by routine histopathologic study, expected five year survival rate is 85% (Fig 23) Stage II comprises primary lesion with demonstrable metastasis in central or basal axillary nodes only, expected five year survival rate is 50% (Fig 24) State III covers primary lesion with apical lymph nodal metastasis involving 50% or less of demonstrable apical axillary nodes expected five year survival rate is 30% (Fig 25) Stage IV describes primary lesion with extra axillary metastasis or metastatic involvement of more than 50% of demonstrable apical axillary lymph nodes expected five year survival rate is 15% (Fig 26)

Unfavorable factors which will increase the basic stage of the breast cancer by one stage include scirrhous primary carcinoma over 3 0 cm in diameter, coexistent pregnancy or lactation, inflammatory signs or vascular or lymphatic permeation, medial half breast lesion with positive axillary lymph nodes and anaplastic rapidly growing carcinoma Favorable factors which will decrease the basic stage by one stage include medullary carcinoma with lymphoid stroma, infiltrating papillary duct carcinoma, marked preservation of acinar or pseudoacinar pattern and diffuse or extensive mucoid degeneration. In the event that favorable or unfavorable factors are not applicable or cancel out, the

(2) Am Surgeon 19 1144 1151 December 1953

Supra clavicular lymph nodes

Apical subclavian lymph nodes

Thoraco acromial artery

Axillary art.

Axillary vein

Central and basal l nodes

Internal Mammary L. nodes

Pectoralis minor m.

Pectoralis major m.

Primary Ca

Fig. 23 —Stage I primary carcinoma limited to breast expected five year survival rate approximately 85%. (Courtesy of McQueeney A. J Am. Surgeon 19 1144 1151 December 1953)

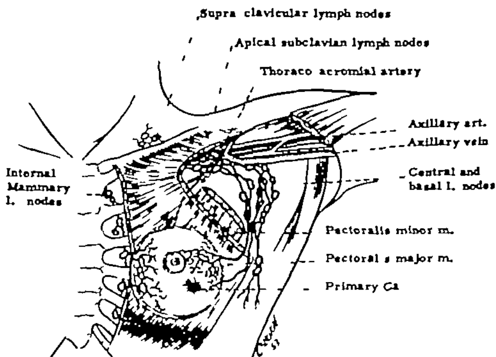


Fig. 24 —Stage II, metastasis t central or basal axilla only expected fi e year survival rate approximately 50% (Courtesy of McQueeney A. J Am. Surgeon 19 1144 1151 December 1953)

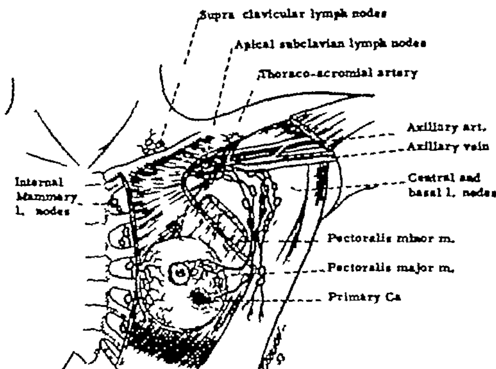


Fig 25—Stage III, metastasis to apical axilla involving 50% or less of apical lymph nodes expected five year survival rate approximately 30% (Courtesy of McQueeney A. J Am. Surgeon 19 1144 1151 December 1953)

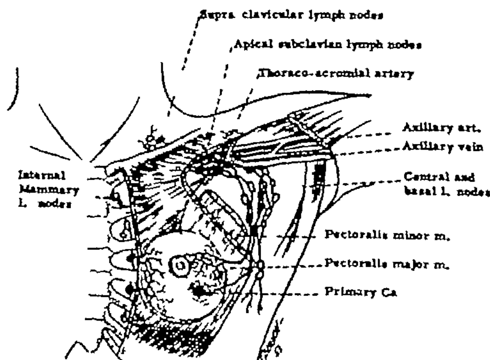


Fig 26.—Stage IV extra-axillary metastasis or metastasis involving more than 50% of apical lymph nodes expected five year survival rate approximately 15%. (Courtesy of McQueeney A. J: Am. Surgeon 19:1144 1151 December 19 3)

original anatomic stage is retained as the final stage for classification purposes

Radical Radiotherapy in Breast Cancer Analysis of Modified McWhirter Technic Frederick R Gilmore[3] (Watts Hosp, Durham) calls attention to the urgent need for a uniform clinical classification of breast cancer, so that all clinics can compare statistically both diagnostic and therapeutic efforts and thereby eliminate the existing confusion in surgical and radiotherapy literature as to the best treatment in this disease

Results in 34 patients treated with a modification of McWhirter's radical method of radiotherapy were analyzed Factors included a 250 kvp constant potential at 50 cm. focus skin distance with Thoraeus II filter (half value layer 3 7 mm. Cu) over the chest wall Two opposing portals each received 300 r in air daily with bolus applied, and treatments were given 6 days weekly for 3-4½ weeks The average total air dose of 13,000 r delivers a tumor dosage of 3 700 r to the axilla, 3,600 r to the supraclavicular portal and 3,500 r to the midplane of the chest wall

About half the patients had uncomfortable arm edema, one third pulmonary fibrosis and one fourth some degree of radiation necrosis of the surgical scar area, with occasional pathologic rib fractures from necrosis Cutaneous metastases to the chest wall and recurrences are rare with this radical therapy Heavy irradiation to skin grafts or tight skin flaps must be avoided after radical mastectomy in order to prevent complications, and heavy adequately filtered tumor dosage is essential for sterilization of the cancer

[This report does not seem very encouraging to the editor Certainly more reports of patients treated by this method must be made before one can have any satisfactory opinion of its value.—Ed.]

Metastasis from Mammary Carcinoma to Supraclavicular and Internal Mammary Lymph Nodes J J McDonald, C D Haagensen and A. P Stout[4] (Columbia Univ Presbyterian Med Center) have attempted to establish precise clinical criteria which will permit selection for radical mastectomy only the patients who have some chance of cure

Operation never achieves cure when metastases have

(3) North Carolina M J 14 617 622 December 1953
(4) Surgery 34 521 542 September 1953

reached the subclavicular lymph nodes, because the disease has reached the closely adjacent grand central lymphatic terminus and has entered the venous stream or lodged in the sentinel supraclavicular node Cancer emboli passing through the main axillary route must pass through several node filters before reaching the subclavicular nodes The interpectoral and transpectoral collecting lymphatics go more directly to the subclavicular nodes than the axillary route

The collecting lymphatics of the internal mammary route drain the central and medial portions of the breast, follow the perforating blood vessels and empty into the nodes of the internal mammary chain These nodes are concentrated in the upper three interspaces When the axillary nodes are blocked there is an increasing tendency for deviation of lymphatic flow toward the internal mammary route

In cases of doubtful operability, a triple biopsy is done preliminary to decision as to treatment Biopsy specimens are taken from the primary tumor and from the nodes in the upper three intercostal spaces and a block dissection of the supraclavicular nodes is carried out Radical mastectomy is done in one week if the internal mammary and supraclavicular nodes contain no metastases Triple biopsy is indicated in all patients with clinical evidence of axillary metastases with tumors of the central and inner half of the breast and when operability is doubtful because of extent of local disease In 8 of 13 cases with triple biopsy, metastases were found in both the supraclavicular and internal mammary nodes

Block dissection of the internal mammary chain is unjustified unless biopsy has proved that the supraclavicular nodes and the internal mammary region in the first interspace are not involved Few cases meet all criteria for this procedure Patients in whom breast carcinoma is deemed inoperable should be treated by radiation

Invasion of Internal Mammary Lymph Nodes in Carcinoma of Breast. R S Handley and A C Thackray[5] point out that the internal mammary lymph nodes receive lymph chiefly from the medial side of the breast and from the

(5) Brit. M. J 1 61-63 Jan. 9 1954

region of the nipple but that there is considerable overlap in the areas drained by them and by the axillary system. Afferent lymphatics from the breast reach the lymph chain by perforating the intercostal muscles, usually where the anterior perforating arteries emerge The nodes lie posterior to the intercostal muscles, are inconstant in position and number and are often very small The chain begins in the 6th intercostal space, where it receives lymph from the diaphragm and liver, and ends, again inconstantly, in a node which lies behind the sternal head of the sternocleidomastoid muscle and which discharges directly into the great veins Nodes most often occur in the 2d, 1st and 3d spaces in that order, and it is to these nodes that lymph from the breast is mostly discharged

Biopsy of the internal mammary lymph chain was carried out at operation on 150 patients. Invasion of the chain by carcinoma was found histologically in 29% of 139 with "operable" breast cancer and in 8 of 11 with "inoperable" cancer Invasion was three times as frequent when the primary growth was in the inner half of the breast as when it was in the outer half It was found in over two thirds of the patients with primary growths in the inner half of the breast and metastasis in the axillary lymph nodes Eight patients without axillary involvement had invasion

Three year survival studies revealed that of 24 patients without axillary or mediastinal lymph node involvement 22 were well of 24 with only axillary node invasion 18 were alive, but 5 had recurrence of 4 with invasion of the internal mammary nodes only, all were well, and of 23 with invasion of both internal mammary and axillary nodes, 8 were alive but 3 had recurrence

Surgical excision and radiotherapy are the only potentially curative methods at present for attacking the internal mammary chain They have been used by the authors and others, but final assessment of their value is not possible A number of supraradical operations have been devised More must be known about the biochemistry of tumor growth and host resistance to breast cancer before a cure can be obtained

Incidence of Cancer with Nipple Discharge and Risk of Cancer in Presence of Papillary Disease of Breast Alson R Kilgore, Ruth Fleming and Manuel Mario Ramos[6] (San Francisco) have studied 190 patients with nipple discharge In about one-sixth, the discharge was either grossly milky or contained microscopic elements of normal secretion This type of discharge has not been associated with cancer Among 85 patients with a serous discharge containing no blood at first examination, the discharge was never bloody on subsequent examination, of this group three had papillary disease and one had papillary disease and cancer Blood-containing discharge was noted on one examination or another in 103 patients, 31 of whom refused all treatment, in 17 others, cancer or "debatable" cancer was found on first operation 4 of the 14 with cancer and 2 of the 3 with debatable cancer had no palpable mass The authors have not had uniform success with any of the usual methods of localization and therefore feel that the risk of undiscovered lesions in the breast is considerable in the absence of a palpable lump

Multiple lesions were found in 14 of 49 patients with proved intraductal papillomas and bilateral papillary disease in only 2 Of 79 patients with papillary disease followed by the authors 6 were found to have cancer in close association or as apparent extension. Of 57 patients treated with local excision of papillary lesions, 6 subsequently had cancer in the same breast, within two to five years

The authors have found that 4 6% of women with blood containing nipple discharge had cancer without palpable mass and believe that the woman of cancer age (40 or beyond) who has blood-containing discharge and so either cancer or presumably papillary disease, would be well advised to accept mastectomy in view of the commonness of multiple papillary lesions and the uncertainty of their discovery Even in younger women with proved multiple papillary lesions, especially if they are in separate areas of the breast and certainly if atypism of papillary epithelium has been demonstrated should accept mastectomy

(6) Surg., Gynec. & Obst. 96 649-660 June 1953

Antecedent Factors in Cancer of the Breast Edwar Lewison and L Willis Allen[7] (Johns Hopkins Hosp) s ied 272 patients with benign breast disease, 186 with m nant breast disease and 107 without breast disease (trol) There was a slight increase in the number of br cancer patients in the menopausal period and a slight crease in the postmenopausal period. The relation of variation to tumor regression following hormone imbal of castration or sex steroid therapy deserves careful sideration

There was a family history of breast cancer in 9 1% the patients with breast cancer, in 5 5% of the pati with benign breast disease and in 1 9% of the conti Thus the incidence of breast cancer in the family of tients having this disease was almost five times that in controls

There appeared to be no significant difference in incide of gynecologic disease between patients with and th without breast disease The incidence of single women, a 35-56 in the cancer series was 6 6%, in the benign br series, 3 9%, and in the controls, 3 4% The fertility r as determined by the average number of pregnancies, 1 6 times greater in the control than in the cancer gro Lactation histories revealed that, whereas 18 5% and 19. of the children in the cancer and benign series were breast fed, only 9 4% of children of the controls were breast fed. There was a much greater preference am the cancer and benign breast disease groups not to nu *their children than among the control group* Augmentat by use of the breast pump was practiced in 25% of won without breast disease but in only 8 7% with breast canc Massage was frequently practiced by women with beni and malignant breast disease but seldom by women with breast disease

The concept of early diagnosis and timely therapy affo the highest hope of greatest benefit. Thus it is imperat that the index of suspicion become more discerning of m lignant disease on less clinical evidence If the aforem tioned antecedent factors indicate a predisposition towa

(7) Ann. Surg. 138 30 50 July 1953

breast cancer, frequent and regular re-examination seems the surest means of early recognition

Carcinoma of the Breast Results, Evaluation of X radia-ion and Relation of Age and Surgical Castration to Length f Survival. George V Smith and Olive W Smith[8] (Brookne, Mass) studied the treatment and the 5 20 year survival rates of 739 consecutive, unselected women with cancer of the breast seen over a period of 40 years Primary x ray treatment in conjunction with surgery had prolonged life in patients with axillary metastases Study of grade 2 and grade 3 cancers (graded according to increasing histologic degree of malignancy) showed that irradiation had been salutary only in patients with grade 3 tumors In this group highest rates of survival were found not only among those with positive nodes but among those with negative nodes

The lowest percentages of survivors were in the 40-60 age group i e., during the pre and postmenopausal climacteric. Prophylactic ovariectomy prolonged life not only in women under 40 and over 59 but more often in those 40-59 There was some evidence of lengthened survival from prophylactic irradiation of the ovaries

The finding of a lower percentage of survival in women with ovaries is not new but that it is still lower during the 5-10 years before and after the menopause is a new observation. A plausible explanation of these observations is that (1) before the climacteric the effect of estrogen is interrupted monthly by the change of its metabolism and the temporary reduction of its secretion, due to cyclic production of progesterone, (2) during the climacteric, estrogen effect is at first less completely interrupted periodically then not interrupted at all because of deficient secretion and then absence of progesterone and (3) in older women estrogen effect is continuous even though minimal, because of its continued elaboration as indicated by ovarian stromal hyperplasia The hypophysis may be involved in the process

Higher percentages of survival among patients who had had prophylactic ovariectomy were found in both pre and postmenopausal groups This procedure deserves a more ex

(8) Surg., Gynec & Obst. 9 508 516 October 1953

tensive trial in women up to 70 with axillary metastases. Ovariectomy should be performed as early as possible, or ovarian irradiation should be given if operation is contra indicated

Hormones and Human Breast Cancer Geoffrey Hadfield[9] notes that there is a relationship between certain endocrine organs and the growth of some human breast cancers Hor mone dependence is demonstrated by some human breast cancers whose continued existence depends on a supply of one or more sex hormones The fertile epithelial cells of the duct system of the breast are extremely sensitive to the mitogenic and growth stimulating action of ovarian estrogen.

As most human breast cancers arise in estrogen-sensitive epithelium, the cancer cells may also need an estrogenic substance for continued multiplication. Such estrogenic tumor maintaining hormone need not arise from the atroph ic graafian follicles after menopause, other ovarian tissue or other organs may remain sensitive to pituitary gonadotropic hormones and be capable of estrogen production. After gonad removal the adrenal cortex may become a rich source of estrogen. The fact that the adrenal cortex may be a source of either male or female sex hormones led Hug gins to perform bilateral adrenalectomy for prostatic and mammary cancer

Since the incidence of breast cancer declines during the years of the menopause, then resumes the upward trend, it is supposed that breast cancer before the menopause is ovarian-estrogen dependent and after, adrenal dependent. Based on evidence from vaginal smears 30% of postmenopausal women produce endogenous estrogen, probably from the adrenal cortex.

The anterior pituitary acts as the hormone regulating center, producing trophic hormones, each the chemical stim ulus for its target organ, which produces tissue affecting hormones Tissue utilization of tissue-affecting hormone affects the blood level of this hormone which controls re lease of trophic hormone from the anterior pituitary Fol lowing the menopause, the low level of ovarian estrogen

(9) Ann. Roy Coll. Surgeons England 14 21 34 January 1954

acts as a perpetual stimulus to the anterior pituitary with excessive gonadotropin production Estrogen production by the adrenal cortex after ovarian atrophy does not affect production of gonadotropic hormone

Large doses of estrogen have produced temporary clinical regression of human breast cancer These large doses may inhibit gonadotropin production by the pituitary with significant decrease in endogenous estrogen formation with disuse atrophy of the unstimulated ovary

The fact that hormone-dependent breast cancer may, by becoming hormone independent acquire resistance to hormone therapy precludes use of hormone therapy as the only or major form of treatment Hormone therapy is indicated for hormone-dependent growths as soon as possible after operation

The only means of determining hormone dependence is by therapeutic trial. Attempts should be made to assess the functional state of gonads, secondary sex organs adrenal cortex and pituitary before hormone treatment is instituted and investigations repeated during treatment

Hormonal Treatment of Cancer of Breast is discussed by Erna Schmidt Ueberreiter[1] (Univ of Vienna), who feels that the results of breast surgery in cancer are improved by cessation of ovarian activity This cessation can be achieved either by surgical castration or by roentgen castration combined with hormonal therapy

Hormonal treatment is helpful not only in supporting the effects of radiation to the ovaries but also when in the wake of surgical and roentgen treatment of the breast the patient's general condition deteriorates. It also has a favorable influence on side effects of radiation therapy

In all such instances, androgens would be the hormone of choice in 150-300 mg doses a week How long treatment should last has not been settled Some advocate discontinuance when no further improvement is seen whereas others prefer indefinite continuation, although with smaller doses Patients should be closely watched for side effects especially an increase in serum calcium levels

---

(1) Wien klin Wchnschr 6 101 10 3 Oct 3 1952

Evaluation of Endocrine Therapy for Advanced Breast Cancer Measurement of urinary excretion in patients with osteolytic metastases from breast carcinoma provides a sensitive, objective index of the rate of tumor growth Hypercalcemia indicates rapid bone destruction, however, the serum calcium content does not rise above normal until the urinary calcium excretion exceeds 500 mg /day The serum phosphorus level is usually elevated (5 mg /100 cc) in the presence of active osteolytic disease and returns to normal (3 2 mg) when remission is induced. The serum alkaline phosphatase level usually rises within two weeks of a remission, then returns to normal and is indicative of increased osteoblastic activity

Olof H Pearson, Charles D West, Vincent P Hollander and Norman E Treves[2] (New York City) studied the rate of osteolysis in six premenopausal women with osseous breast metastases during a menstrual cycle, after surgical oophorectomy and during administration of ovarian hormones In three, urinary calcium excretion rose during the menstrual cycle and fell at onset of menstruation Oophorectomy was followed by prompt decline of urinary calcium excretion to normal and by symptomatic improvement. Estrogens produced a return of hypercalcuria and bone pain withdrawal was followed by prompt disappearance of hypercalcuria and gradual subsidence of bone pain In all three remission followed oophorectomy, and was maintained in two

In the other three, there was no fluctuation in urinary calcium excretion during the menstrual cycle or menstruation Oophorectomy failed to influence the level of calcium excretion Estrogens suppressed calcium excretion but not to normal levels When estrogens were withdrawn, urinary calcium excretion increased and hypercalcemia appeared No clinical improvement followed oophorectomy

All six patients had the same type of infiltrating duct carcinoma The study shows that there are two types of breast cancer, one dependent on estrogens, the other not The two types cannot be distinguished clinically or histologically Only the estrogen type is benefited by oophorectomy

( ) J A M A 154 234 239 Jan. 16 1954

Less than 50% of women with breast cancer benefit from adrenalectomy It is not always possible to correlate the response to adrenalectomy with the degree of differentiation of the tumor Response to castration was correlated with subsequent response to adrenalectomy in 10 patients Of four who failed to respond to castration none responded to adrenalectomy, whereas of six who had objective remission following oophorectomy three had objective remission following adrenalectomy and two had some alteration in tumor growth Thus failure to respond to castration suggests failure to respond to adrenalectomy, but more observations are necessary before final conclusions can be drawn

Three women with osseous metastases from breast carcinoma who did not respond to castration, responded to 200-300 mg cortisone daily The cortisone reduced urinary excretion of calcium to normal levels

Surgical oophorectomy is the treatment of choice for estrogen-dependent tumors When relapse occurs, adrenalectomy should be done When relapse follows adrenalectomy testosterone therapy should be tried. Hypophysectomy is being explored as a possible means of completely suppressing adrenal cortical function There is no well defined physiologic basis for treatment of patients with non-estrogen dependent mammary cancer

[The authors have presented a very stimulating concept that there are two kinds of breast carcinoma from a physiologic standpoint, of which one is dependent for its activity on estrogens and the other not. If this idea survives it may have an important bearing on cancer of other organs in showing similar physiologic differences —Ed.]

Ovarian Influence on Survival in Breast Cancer Sheldon C Sommers, Henry A Teloh and Gloria Goldman[3] (Harvard Med. School) studied life spans after the onset of disease in 125 patients who had died of breast cancer and compared the 102 (82%) with hyperplastic ovarian cortical stroma and the 23 (18%) others with atrophic ovaries Average total duration without castration in the two ovarian groups was nearly identical according to separate analysis of cases of all women who had had mastectomy and all those not treated. In another group treated both by mastectomy

(3) A.M.A Arch. Surg 6 916-919 December 1952

and castration, the comparable total duration differed considerably 47 months for those with hyperplastic ovarian stroma, as against 29 months for those with atrophic ovaries

Without statistical proof, the study indicates that, after mastectomy in women with hyperplastic ovarian stroma, castration may help to prolong life Ovariectomy should therefore be considered both before and after the menopause in patients with breast cancer

Augmentation Mammaplasty by Lipotransplant H O Bames[4] (Los Angeles) has utilized gluteal fat to build up

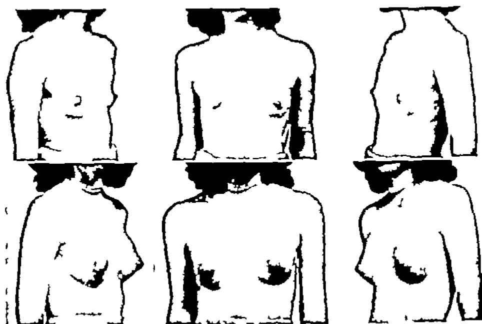


Fig. 27 (top) —Preoperative.
Fig. 28 (bottom) —Six weeks later
(Courtesy of Bames, H. O: Plast. & Reconstruct. Surg 11 404 412 May 1953)

an undeveloped breast in otherwise mature women. The grafts are taken with the vascularly rich tissue existing on both sides by resecting the graft with the subjacent fascia and overlying skin in place The epidermis is removed with a dermatome set at 0 02

TECHNIC.—Grafts are taken from both buttocks so as to give an adequate graft in extension and thickness and to give the least amount of visible scar An elliptical shape of the graft makes clo

(4) Plast & Reconstruct Surg 11 404 412 May 1953

sure of the donor area easy. The existing mammary tissue is freed from the chest wall through an incision in the inframammary sulcus. The graft, guided by retractors, is allowed to glide into the bed and the skin and fascia are closed. Several nonabsorbable skin implant skin transfixation sutures are placed transversely to maintain absolute immobilization between existing breast tissue and implant. Ad hesive splinting over the dressing is applied in brassiere style. The arms must not be raised over shoulder height in order to prevent motion of the graft on the chest wall.

The procedure is of value not only in improving bust contour when it is developmentally insufficient (Figs 27 and 28) but also in re-creating this same effect in the woman who has lost it through radical breast amputation.

Use of Local Pedicle Flaps for Reconstruction of Breast after Subtotal or Total Extirpation of Mammary Gland and for Correction of Distortion and Atrophy of Breast Due to Excessive Scar. J. J. Longacre[5] (Cincinnati) has reconstructed the breast after removal for chronic cystic mastitis, mastodynia or virginal hypertrophy.

TECHNIC.—A local dermofat pedicle obtained from the lower segments of the breast is rotated through an arc of about 135 degrees with the tip of the pedicle anchored to the pectoral fascia overlying the third rib. At the same time a free transplant of the nipple is done. Size and number of pedicle flaps can be varied to provide sufficient soft resilient tissue for reconstruction after removal of the pathologic process.

The dermofat pedicle flaps have the added advantage of increased blood supply through preservation of the extensive subcutaneous rete of blood vessels. The resilience of the derma creates a firm breast and the strength of its fibers and elastic tissue makes permanent anchorage more certain.

The procedure was used in a girl, aged 15, with extreme scar tissue distortion of the right breast resulting from a severe third degree burn of the right thorax, axilla and arm at age 5. There was dense scarring from the right axillary region to the groin, with marked downward displacement of the breast, so that the right nipple was 12.5 cm below the left. The entire right breast was markedly flattened and under tension with resultant atrophy (Fig. 29).

(5) Plast. & Reconstruct. Surg. 11: 380-40, May 1953.

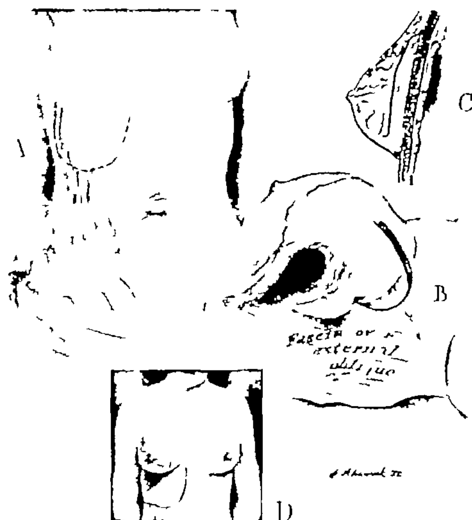


Fig 29.—*A* Marked distortion and atrophy of right breast due to pull of cicatricial tissue from old burn. Dotted line indicates line of incision. *B* Fibrofat pedicle which is being directed into retromammary space. *C* Cross-section of breast indicating anchorage of pedicle to pectoral fascia overlying second rib. *D* By this procedure a more normal contour and elevation of the breast has been attained. The denuded area over the pectoral and external oblique fascia has been corrected with a large deep intermediate graft. (Courtesy of Longacre J J Plast & Reconstruct. Surg 11 380-40 May 1953)

Use of Pedicle Dermofat Flap in Mammaplasty Jacques W Malmiac[6] (New York City) believes that although in most hypertrophic breasts plastic reconstruction is best achieved by a transposition whereby the secretory elements are preserved, the procedure of choice in massive breast enlargements of epithelial character is total mammectomy with free transplantation of the nipples.

(6) Plast & Reconstruct. Surg 12 110-115 August, 1953

TECHNIC.—With the alveolar skin under stretch a full thickness areolar graft is taken and the dissection continued over the nipple to a depth of about 0.5 cm. (Fig 30) Epithelium on the posterior aspect of the breast is removed with Brown's electric dermatome to

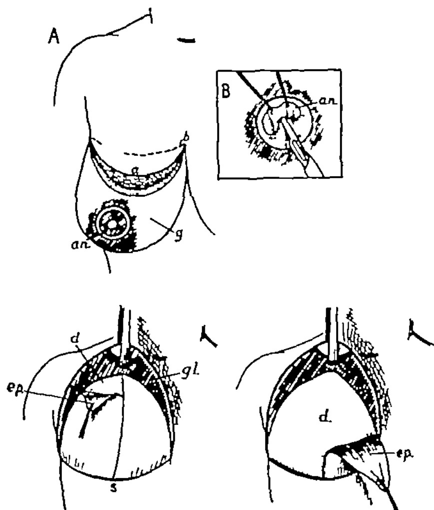


Fig. 30 (top).—A outlining of anterior flap and preparation of areola nipple graft an., circular incision around nipple a, anterior flap outlined between ends of submammary fold, b g lateral area of skin to be removed. B dissection of areola-nipple graft an.

Fig 31 (bottom, left).—Removal of epithelium (ep.) from posterior aspect of breast d derm gl., central part of breast to be removed s summary fold.

Fig 32 (bottom, right).—Exposure of derm, d with removal of epithelium almost completed.

(Courtesy of Malinlac J W Plast. & Reconstruct Surg 12 110-115 August, 1953)

prepare a posterior dermofat flap to serve as filling material for the reconstructed part (Figs. 31 and 32) An anterior flap is outlined by concave incision extending toward the upper margin of the areola. The posterior flap is incised around the de-epithelialized area on the posterior aspect, extending from the lower areolar margin to slightly

above the submammary fold. The incision above the fold is made only through the derma, thereby providing for a dermofat pedicle flap The anterior and posterior flaps are separated from the gland with all subcutaneous tissue available and the glandular tissue is thoroughly removed (Fig 33) The posterior dermofat flap is partly discontinued along the submammary fold through blunt dissection from the underlying fascia and from the submammary skin. To reduce excess width of the breast, the posterior pedicle is detached along its lateral insertion and folded upon itself in several layers,

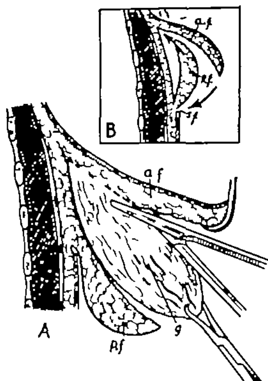


Fig 33 —*A* total glandular excision, *g* between anterior *af*, and posterior *pf*, flaps. *B* insertion of posterior pedicle dermofat flap *pf* beneath anterior flap, *af* Note continuity of pedicle along submammary fold, *sf* (Courtesy of Malbac, J W Plast. & Reconstruct. Surg 12 110-116 August, 1953)

to reproduce the central prominence of the breast (Fig 34) The upper end of the folded dermofat flap is attached to the pectoral fascia under slight tension. With the patient half sitting, the superimposed flaps receive final shaping

In a one stage procedure, the anterior flap is reduced along the midline by removal of a skin triangle extending from the center of the ultimate location of the nipple to the submammary fold. The lateral flaps are adjusted and sutured along the midline and submammary fold For the areola nipple graft, the epidermis from the recipient zone is dissected leaving the basal layer of the derma as a bed for the graft, which is affixed with interrupted 4-0 Nylon

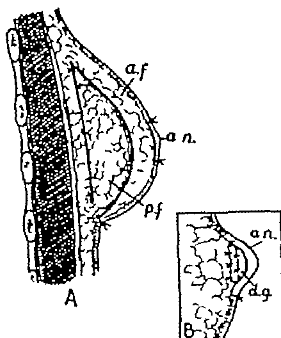


Fig. 34 —*A* position of dermofat flap, *p.f.*, beneath anterior flap *a.f* Areola nipple graft, *a.n.*, in place *B* two-ply dermal graft, *d.g.*, beneath nipple graft, *a.n.*, inserted in a later stage (if required) for elevation of nipple surface (Courtesy of Maliniac J W Plast. & Reconstruct. Surg. 12 110-116 August, 1953)

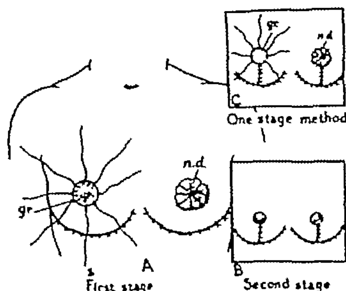


Fig 35 —*A* suturing and dressing of nipple-areola graft in new site *Left* central portion of graft, *gr.*, affixed to bed by running suture. Interrupted sutures, *s* cut long enough to tie over dressing Right, dressing over graft, immobilized by tying long interrupted sutures over it *B* formation of two lateral flaps through reversed T incision at second stage *C* foregoing steps carried out in one stage. (Courtesy of Maliniac J W Plast. & Reconstruct. Surg 12 110 116 August, 1953.)

sutures cut long enough to be tied over the pressure dressing applied to the graft (Fig 35) The dressing over the graft and that over the breast as a whole should be independent to allow for early removal of the submammary sutures The dressing on the nipple graft is not disturbed for 10 days. An anterior horizontal flap is best avoided as it makes the breast look flat.

Swelling of Arm after Radical Mastectomy Clinical Study of Its Causes William T Fitts, Jr, John G Keuhnelian, I S Ravdin and Stanley Schor[7] (Univ of Pennsylvania) report that of 130 patients who had radical mastectomy between July 1946 and July 1951, with follow up to July 1952 or until death, 64 had arm swelling Minimal swelling with no symptoms occurred in 28, mild swelling with no disability in 18, moderate swelling with some disability in 9 and severe swelling with recurrent attacks of lymphangitis and severe disability in 9

No one factor was the determinant in development of arm swelling, although several factors that might relate to lymphatic obstruction seemed to be important The number of axillary lymph nodes removed, marginal necrosis and obesity appeared to be the most important from a detailed statistical analysis The incidence of other factors which might be related to lymphatic obstruction—percentage of lymph nodes involved with cancer fever after operation, fluid collection and definite infection—was only slightly higher in the group with swelling Penicillin, given prophylactically to most patients did not appear to reduce the incidence of swelling

(7) Surgery 35 460-464 March 1954

Reaction of Pulmonary Tissue to Lipiodol.® Warren L. Felton II[8] (Yale Univ.) studied 37 lung specimens from 34 patients who had received intratracheal injections of iodized oil 3 weeks to 47 months before operation. Histologic examinations were done by a technic which differentially stains lipiodol.®

In 23 specimens, residual lipiodol® was demonstrated histologically. X-rays disclosed residual lipiodol® in all except two. In 16% of the specimens examined (26% of those containing residual lipiodol®) focal peripheral foreign body granulomas surrounding lipiodol® droplets were observed. Concentrations of the medium in areas of organizing pneumonitis were found in eight specimens. The development of granulomas may be related to abnormal retention of lipiodol® in emphysematous regions.

Lipiodol® when not involved in a granulomatous process lies in droplets free or phagocytized in alveolar and bronchial lumens and it is probably eliminated entirely by way of the tracheobronchial passages. There is no evidence of localization of the medium in lymphatics, lymph nodes or in bronchial walls or cartilages.

As granulomatous reaction to retained lipiodol® in the lung appears to be more common than is generally realized the search for a more suitable contrast medium should continue.

Influence of Bronchography on Function of Lung with Regard to Anesthesia. Paul Schostok[9] (Giessen, Germany) made spirographic studies of patients who underwent bronchography. Results showed a 21.1% decrease of vital capacity when local anesthesia was used; the impaired function persisted for five to seven days. By contrast when general anesthesia was used practically no reduction in respiratory function and sometimes even improvement was evident.

---

(8) J Thoracic Surg. 25 530-544 May 1953
(9) Thoraxchirurgie 1 1 121 June 1953

The most striking observation was a 28% decrease in supplemental air on the first day after bronchography, suggesting a decrease of the lung parenchyma. Results of the epinephrine test (Rossier and Méan) suggested that impairment of breathing capacity was not due to functional spasm of the bronchi but to an organic process There probably was actual inflammation. Bronchoscopic examinations after bronchography supported this concept The entire bronchial mucosa was inflamed and tended to bleed. The hypertonic, water soluble contrast medium is not harmless. Experiments have shown that it produces inflammation in animals

The following factors have to be considered in seeking the cause for diminished respiratory function after bronchography (1) Premedication with barbiturates and morphine, this can be a factor only when large doses are given, e g, 0 3 Gm. luminal,* 0 01 Gm morphine cannot exert much influence (2) The influence of local anesthesia appears to be small (3) Water-soluble contrast medium appears to cause acute tissue reaction Despite its absorption by the bronchial system, its presence leads to considerable inflammatory changes for some time The prompt removal through the tracheal tube and under x ray guidance of all contrast mediums and secretions reduces the danger of damage by contrast mediums (4) Bronchial secretion after bronchography can reach a great volume despite atropine and scopolamine therapy, and its removal relieves the patient immensely

Patients whose respiratory compensation is precariously balanced do better under general than local anesthesia.

Arterial Oxygen Tension in Rest and during Effort as Test of Pulmonary Function. Viking Olov Björk, Pan A Michas and Lars G Uggla[1] (Stockholm) report on the arterial Po_2 and Pco_2 at rest and during effort in 29 healthy persons and in 108 patients with pulmonary disease These values were correlated with the ventilation, respiratory reserve and mixing

Because at high tensions the slope of the oxyhemoglobin dissociation curve is flat, the tension method is more suit

(1) J Thoracic Surg 25 558-569 June 1953

able than the saturation method for accurate determination of small variations in the arterial oxygen content Blood samples from the pulmonary capillaries have a statistically significantly higher oxygen tension than samples from the brachial artery The Po_2 determination may therefore be used as an indication that the heart catheter is in position for reading the pulmonary capillary pressure

A significant correlation was found between the maximal breathing capacity and the arterial Po_2 at rest in both men and women. The minute ventilation during effort (MV effort) in per cent of MBC (maximal breathing capacity) showed a statistically significant correlation to the arterial Po_2 at rest The relationship 100—MV effort/MBC was therefore chosen as an expression of ventilatory reserve

Arterial Po_2 was considerably lower in patients with a high than with a low residual capacity The ventilatory reserve was much lower in patients with a high residual capacity When the resting arterial Po_2 was low the Po_2 during effort was low as well. Effort had no significant influence on the arterial Po_2 in patients with a low pulmonary reserve This may be due to hyperventilation during effort Therefore a significant change of arterial Po_2 during effort cannot be used as an indication of pulmonary reserve

Resting arterial Po_2 is a good indication of the pulmonary reserve and therefore can be used as a test of lung function.

[A simple and reliable test of pulmonary function is one of the most pressing needs in lung surgery It is to be hoped that this method will prove to be what is needed.—Ed.]

Pulmonary Function and Circulatory Dynamics in Artificial Pneumoperitoneum II. Studies on Patients with Pneumoperitoneum as Therapeutic Measure in Pulmonary Emphysema. Ross C Kory Dan C Roehm, George R Meneely and Robert A. Goodwin, Jr [2] (Nashville Tenn) evaluated the effect of pneumoperitoneum on cardiovascular dynamics as well as pulmonary function in patients with pulmonary emphysema Study was made of five men with chronic pulmonary emphysema whose symptoms had persisted for at least one year All had reached a "therapeutic plateau" on conservative therapy before study Pulmonary capacity,

(2) Dis. Chest 23 605-6 0 June 1953

ventilation studies, arterial gas measurements, intracardiac, pulmonary artery and "capillary" pressure and cardiac output determinations were made They were studied again *one month or more after pneumoperitoneum was initiated.*

In three who obtained definite clinical improvement there was an increase in inspiratory capacity, the two unim proved patients showed minimal decreases in inspiratory capacity (Fig 36) In like manner there was a reduction in residual air, total capacity and ratio of residual air to total

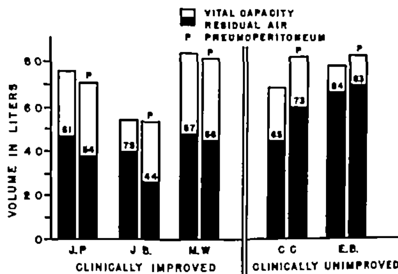


Fig 36 —Pulmonary volume without and with pneumoperitoneum. Numbers just above solid bars indicate ratio of residual air to total capacity (Courtesy of Kory R. C *et al* Dis. Chest 23 608-620 June 1952)

capacity Those who were not improved showed increases in both residual air and total capacity

Figure 37 represents the findings of the ventilatory studies. The maximal breathing capacity and the ratio of breath ing reserve to maximal breathing capacity improved in the three clinically improved patients The arterial oxygen saturation at rest increased to some degree in all except one, and arterial carbon dioxide content and tension fell appreciably in the three who showed improvement

The results of the cardiovascular function studies are de picted in Figure 38 Oxygen consumption in general showed decrease following pneumoperitoneum, perhaps because of lessened anxiety and decrease in muscular effort The car

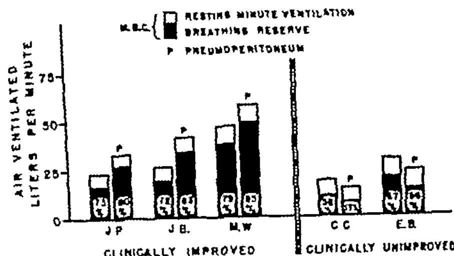


Fig 37.—Ventilatory studies without and with pneumoperitoneum. Percentages represent ratio of breathing reserve to maximal breathing capacity (Courtesy of Kory R. C. et al Dis. Chest 23 605-6 9 June 1953)

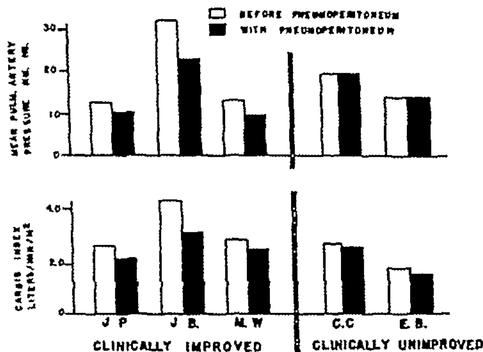


Fig 38.—Pulmonary artery pressure and cardiac index. (Courtesy of Kory R. C., et al. Dis. Chest 23 605-620 June 1953.)

diac output decreased in all five, with no change in the arterial blood pressures In one patient with cor pulmonale and pulmonary hypertension there was a sizable reduction in pulmonary artery pressure following pneumoperitoneum and attending improvement in blood gases

Improvement in three patients in the absence of increased minute volume suggests that, with reduction in residual air secondary to pneumoperitoneum, a more efficient distribution of inspired air has occurred with an increase in "alveolar ventilation" and more efficient oxygen and carbon dioxide exchange

New Approach to Pulmonary Emphysema. Osler A. Abbott, William A. Hopkins, William E Van Fleit and Joe S Robinson[3] (Emory Univ) studied 294 patients with varying degrees of pulmonary emphysema Of these, 127 were under 50, 102 were 50 60 and 65 were over 65 Most patients between 50 and 60 had apparently healthy vascular systems, the disease had started in their 30's and 40's It was three times as frequent in men as in women. At least 46% had a family history of the disease There was an almost constant history of protracted cough or chronic bronchitis A single agent for such irritation was found in 288 patients, with 178 having a combination of two or more agents

A combination of bronchospasm plus edema of the bronchial tree probably causes partial and intermittent obstruction to air evacuation from the alveoli. It is believed that the pathologic changes of pulmonary emphysema are not due to idiopathic atrophy but are the result of prolonged partial (bronchospasm and edema) and intermittently complete (cough) obstruction of the airway Partial or complete obstruction of one of an interdependent pair of circulations in a single organ results in a decreased flow in the other circulation In the lung, arterial blood flow decreases in response to bronchial obstruction, both mechanically by means of direct intra alveolar pressure on the vessels within the alveolar walls and reflexly through the autonomic nervous system Continued partial or intermittent complete obstruction of a part or all of the bronchial tree produces overdistention of the alveoli and a decrease in arterial blood flow leading to atrophy of lung tissue The authors prefer the term "progressive obstructive pulmonary atrophy" to pulmonary emphysema. The initial local lesion may serve as a trigger area capable of producing arterial and bronchial spasm throughout the involved organ.

(3) Thorax 8 116-132 June, 1953

Pulmonary emphysema has been divided into three specific types Type I is symptomatic disease without permanent organic changes Type II is localized disease in relation to permanent organic change Type III is generalized disease and is subdivided into three groups according to severity

On fluoroscopy, both diaphragms may tend to descend to their full excursion together, but on one side overlying lung tissue cannot fill as quickly as its counterpart therefore the diaphragm on the involved side "jumps back" through a short excursion, then redescends as the overlying lung tissue fills adequately This is reversed in the expiratory phase In severe instances of localized intra alveolar pulmonary hypertension due to obstructive emphysema, the diaphragm on the involved side may be delayed in its ascent during expiration or actually be forced to increase its descent during the expiratory phase Angiocardiographic mapping of the pulmonary vascular system helps to confirm the clinical diagnosis

Conservative treatment was the sole procedure for type I patients and was the means of obtaining a comparative baseline for study of the efficiency of the operative approach in types II and III Sympathectomy or vagotomy alone is rarely a valuable procedure The remaining patients in the series were treated by a combined denervation procedure removing both the sympathetic and parasympathetic system with tissue resection If unilateral surgery was done, the stellate ganglion and the upper six dorsal ganglions were removed The stellate ganglion was preserved if the operation was bilateral. The vagus was transected in its entirety just distal to the recurrent nerve on the right, and on the left the vagus fibers were transected in the hilus of the lung The adventitia of the main pulmonary artery on the side involved was excised to complete the removal of the sympathetic components. If localized bullae were present they were excised When major areas of involvement were confined to one lobe the entire lobe was removed if it was deemed safe without overstretching the remaining lung tissue To avoid raw surface with resulting permanent fistulas, main vessels were ligated in the segments excised

Resection and suturing were done with the Potts coarctation clamps. Dead space was filled by inducing pneumoperitoneum, at the time of resection, to elevate the diaphragm.

Resectional procedures plus plexectomy produced major and striking improvement in 21 patients with bullous and mixed types of emphysema. Tissue resection plus plexectomy produced rather uniform, striking results in patients with diffuse pulmonary emphysema and a unilateral focus or trigger area of irritation. The group with fixed emphysema were not benefited by surgery.

Studies on Re-expanded Lung after Prolonged Atelectasis. In reviewing experience with traumatic rupture of the bronchus, Watts R. Webb (Barnes Hosp.) and Thomas H. Burford[4] (Washington Univ.) became interested in the possibility of reinstituting function in the atelectatic lung. They noted, contrary to the usual assumption, that in not a single case with complete stenosis of the main stem bronchus for periods up to 26 years had suppurative disease of the atelectatic lung developed. Examination of lungs after 26 years, 11 years and 6 months respectively revealed no morphologic changes which appear incompatible with re-expansion and relatively normal function. Studies were then carried out on the circulatory and respiratory function of dog lungs which were re-expanded after relatively long periods of atelectasis by sudden complete occlusion.

METHOD.—One main stem bronchus was transected and the ends closed in each of three dogs. The pulmonary vessels were kept intact. After 7½, 3½ and 3 months respectively the bronchial stumps were dissected out and reunited by end-to-end anastomosis with interrupted sutures. Oxygen saturations were determined on blood from the right ventricle, the inferior pulmonary veins of both treated and nontreated sides and, in one instance, from the aorta. Blood specimens were drawn just before the bronchial anastomosis was done, immediately afterward and at another thoracotomy some weeks after anastomosis. Angiocardiograms and bronchograms were obtained. One dog was killed four weeks after anastomosis and the lung examined grossly and microscopically; one dog was examined at 3½ months, and the other was kept for long term observation of the re-expanded lung.

(4) A.M.A. Arch. Surg. 66:801-809, June 1953.

At operation for anastomosis, the completely atelectatic lung was reduced to a small fraction of its original size and appeared red and meaty The entire bronchial tree was filled with gelatinous mucus which was easily aspirated, usually as a cast. By application of positive pressure, the lung easily re-expanded. Blood passing through the atelectatic



Fig. 39 (left) —Left main stem bronchus four weeks after anastomosis following three months of atelectasis, showing normal lumen One suture is visible in floor of bronchus.

Fig. 40 (right) —Reinflated lung of same dog four weeks after anastomosis. Midline zone shows site of adhesions to thoracotomy incisions.

(Courtesy of Webb, W R. and Burford, T H. A M.A. Arch. Surg 66 801-809 June, 1953)

lung was not being oxygenated Blood flow through the chronic atelectatic lung of one dog was markedly reduced Blood taken immediately after anastomosis subsequently demonstrated adequate oxygenation Postanastomotic chest films showed fairly equal inflation of the two lungs, and angiocardiograms, normal vascular patterns with adequate blood flow to both lungs Bronchography and bronchoscopy revealed minimal or no stenosis The inflated lung of one



Fig. 41 —Dog lung four weeks after reinflation following three months of atelectasis. Bronchus artery and alveoli appear normal. (Courtesy of Webb W B, and Burford, T H. A.M.A. Arch. Surg 66 801 800 June 1952)

dog, removed one month after anastomosis following three months of atelectasis, is shown in Figures 39 and 40 The lung parenchyma, bronchi and vessels (Fig 41) appeared normal.

The procedure has not been utilized clinically but the authors feel that it will be feasible

[This beautiful experiment shows a remarkable restoration to normal function of lung tissue after long periods of atelectasis.—Ed.]

Studies on Lysis of Experimental Pulmonary Emboli Using Trypsin. William W Shingleton William G Anlyan and Karleen C Neill[5] (Duke Univ) attempted to evaluate the effectiveness of a preparation of trypsin in the lysis of experimental pulmonary emboli in dogs

METHOD —Clots of uniform size were prepared with the animal's own blood, allowed to retract for one hour then introduced by way of the jugular into the pulmonary circulation X ray films were made to visualize their position In 11 animals the blood was mixed

(5) Surgery 34 501 509 September 1953

with barium sulfate before clotting Trypsin (15,000 and 20,000 units/kg) was given intravenously to seven animals at 8 hour intervals over 24-48 hours The other four dogs were used as controls and were given 5% dextrose in water A similar series was run on seven animals except that barium sulfate was omitted.

Preliminary experiments indicated that doses of 15 000 25,000 units of trypsin/kg , at a rate not to exceed 3,000 units/minute, caused no observable physiologic change Serum fibrinolytic activity was noted for 8-10 hours following each injection, whereas no fibrinolytic activity was present in controls With the rise in serum fibrinolytic activity there was a fall in antifibrinolytic titer which lasted 12 24 hours The Quick one stage prothrombin time was elevated from four to eight hours after each trypsin injection in all animals The control animals showed 20 30% reduction in clot volume in 24-48 hours whereas the clot was reduced 55-100% in dogs receiving trypsin. In the group with pure clots (no barium) there was practically complete lysis of all clots in 24 hours

Gross pulmonary infarction occurred in 5 of 7 controls whereas only 2 of 11 dogs receiving trypsin had infarcts There were small focal hemorrhages in the wall of the gall bladder in five, and petechial hemorrhages in the pancreas and spleen in two animals These seven received the larger dose of the drug One animal had acute cholecystitis

The effect of trypsin on the fibrinolysin antifibrinolysin equilibrium of the blood is not understood There is evidence that suggests it may activate naturally occurring profibrinolysin

Nonspecific Lung Abscess Experience with 55 Consecutive Cases, seen during 1947 52 is discussed by John R Fox Jr Felix A. Hughes, Jr and Wheelan D Sutliffe (Memphis Tenn) The patients were aged 20-62 and all but one were men. The disease either had an insidious onset or was secondary to a clinically recognized, pneumonic infectious process None was secondary to bronchiectasis, carcinoma, tuberculosis or foreign body Leading symptoms were fever cough, chest pain foul sputum chill, weight loss hemoptysis and toxicity More patients with minimal symptoms and

(6) J Thoracic Surg 7 255 60 March, 1954

less with extreme toxicity were seen in 1950-52 than in 1947-49 The right upper lobe was involved more often than any other, for some unknown reason. However, there was a lower incidence of foul sputum and initial toxicity with these lesions than with lesions in other lobes

Cultures from sputum or bronchoscopic aspiration revealed Staphylococcus aureus, Streptococcus hemolyticus, Pseudomonas aeruginosa, Aerobacter aerogenes, Hemophilus influenzae and Escherichia coli All patients received at least 1,200,000 units of penicillin daily, some received other antibiotics Bronchoscopy was used in almost all cases to rule out other diseases Postural drainage was beneficial when correctly used

Some patients with long standing disease were cured by the antibiotic agents, surgery, when required, was easier with the inflammatory reaction at a minimum. Of 32 patients treated medically, 88% were cured, 9% improved and 3% died Of 23 treated surgically, including drainage in 4, pneumonectomy in 3, lobectomy in 10 and segment or wedge resection in 6, 92% were cured, 4% improved and 4% died.

[Before the days of the antibiotics, pulmonary abscess was a very common disease with a high mortality It seems almost miraculous that it has become so infrequent and so relatively innocuous.—Ed.]

Indications for Surgical Treatment of Pulmonary Suppurations From Statistics in 240 Cases P Santy, M Bérard and J C Sournia[7] (Lyon) consider medical treatment essential to management of pulmonary suppurations. Many patients have been cured by treatment for a few weeks, and others, in whom surgery is contraindicated, are often greatly benefited by palliative medication with sulfonamides or penicillin Surgery should be undertaken (unless contraindicated) if suppuration persists despite prolonged medical treatment In these patients the general condition is usually greatly improved by the time they come to surgery

Preoperative penicillin prophylaxis is important, especially in cases of severe suppuration. Excellent results are obtained by pneumonotomy for a single abscess, multiple

(7) Presse méd. 61 1531 1533 Nov 21 1953

abscesses, diffuse or lobar pyosclerosis and chronic pneumonia should be treated by removal of the diseased area. Many of the authors' 158 patients, 80% of whom were men, were alcoholics, with possible liver, kidney or myocardial impairment, and the suppurative lesions were of long standing and drug resistant, explaining to some extent the 36 deaths. All had undergone various operative procedures. The prognosis for such cases is admittedly poor, although the authors' yearly mortality rate has been declining, largely because of clarification of the indications for surgical treatment. Maximal improvement will be secured only when operation can be undertaken as soon as medical treatment has proved ineffectual.

Cystic Enlargement of Mucous Glands of Bronchus Associated with Chronic Bronchitis.—A. Duprez and R. Mampuys[8] (Univ. of Brussels) studied the mucous glands in the bronchial walls in normal subjects and patients with chronic bronchitis or bronchial inflammation associated with bronchiectasis by bronchoscopy and bronchography, through postmortem examination of fresh and dried lung tissue, through bronchial casts made of acrylic resins and by serial section. The mucous glands of the bronchi are composed of mucous, serous and mixed acinar glands. They lie deep in the submucosa, in the fibrocartilaginous layer and even extend to the peribronchial fat. Most are located between the cartilaginous rings and around the bronchial bifurcations; they are more numerous in the larger bronchi. They disappear in the bronchioles at the level of the cartilaginous rings, i.e., in bronchi of 1 mm. diameter. The ducts of these glands run through the muscular layer, turning sideways under the mucous membrane; such structure is not conducive to the outflow of mucus secretion.

Cystic dilatation of the bronchial glands is the result of repeated attacks of bronchitis accompanied by increase in the secretion of mucus. The dilated glands can be studied by bronchoscopy and occasionally by bronchography. During bronchoscopy, they must be differentiated from lymph node ruptures in the bronchi and true diverticula of the

(8) Thorax 8 141 14 June 1953

bronchi Inflammatory changes persisting around dilated ducts and glands may play a role in reinfecting the lung in cases of long-standing bronchitis.

Hemoptysis Frederick H. Taylor and Thomas H. Burford[9] (Washington Univ) state that there are many causes of hemoptysis but tuberculosis is the most common, bronchiectasis, carcinoma and lung abscess follow in that order Mitral stenosis, pulmonary infarction and bronchial adenoma are less common causes In patients over age 45 bronchogenic carcinoma is the most frequent cause of hemoptysis Patients with hemoptysis should have a thorough examination, including x ray study of the chest, sputum studies, bronchoscopy and, if indicated, bronchography The *mouth, pharynx and sinuses should be excluded* as the bleeding focus. Hemoptysis associated with the raising of pieces of tissue is pathognomonic of carcinoma All tissue must be examined microscopically All lesions seen bronchoscopically should be studied by biopsy If no definite pathology is found by these studies, they should be repeated and monthly x rays taken to make sure that an important lesion has not been missed. The treatment of hemoptysis depends on the disease process

When an acute pulmonary hemorrhage is so profuse that the patient's life is in danger, immediate control of the bleeding takes precedence over the establishment of a definite diagnosis. Most severe pulmonary hemorrhages arise from cavitary disease, primarily tuberculosis These patients rarely die of exsanguination but do die of asphyxia. The bleeding patient must have complete rest, narcotics and pituitrin® intravenously may help Phrenic crush, pneumoperitoneum, pneumothorax or emergency thoracoplasty or lung resection may be necessary

[The increasing frequency of bronchogenic carcinoma is still not sufficiently appreciated by general practitioners, and there is far too much delay in making an accurate diagnosis of the cause of hemoptysis. Also even a patient with proved tuberculosis may also have a carcinoma. We have seen this combination in several cases.—Ed.]

Pulmonary Decortication in Organized Hemothorax is a relatively simple procedure but requires care, patience and adequate postoperative supervision, according to Rodolpho

(9) Missouri Med. 51 19 22 January 1954

L. Figueira de Mello, Fernando L Martins Ribeiro Osmar Sequeira and Gabriel França Filho[1] Mortality rate has been estimated at less than 2%, and rarely does any morbidity follow The established indications comprise chronic traumatic hemothorax, with or without infection, pulmonary encasement, and deforming pleural constrictions—all characterized by formation of a fibrinous coating around the lung Chronic traumatic hemothorax, common after combat wounds, is estimated by some authorities to occur also in 5-10% of civilian intrathoracic injuries Such enzymes as streptokinase streptodornase have sometimes produced excellent results, however, although it sometimes obviates decortication, enzyme therapy is not so much a cure in itself as a valuable supplementary measure The patient with organized hemothorax who fails to respond to streptokinase streptodornase therapy should be treated by decortication unless there are positive contraindications

Congenital Pulmonary Arteriovenous Aneurysm. Robert D Sloan and Robert N Cooley[2] (Johns Hopkins Univ) discuss nine cases Pathologically, the lesions are composed of vascular channels lined with endothelium and a supporting connective tissue stroma Most clinically significant arteriovenous aneurysms of the lung are fundamentally hemangiomas of the so-called cavernous type Usually one border is on the pleural surface of the lung The major arterial supply is usually from a branch or branches of the pulmonary artery, and the venous drainage empties into the pulmonary vein system Since blood bypasses the pulmonary capillary bed, varying amounts of unoxygenated blood are returned to the left side of the heart. The lesions are frequently multiple

Pulmonary arteriovenous aneurysms do not seem to cause any significant disturbance in adjacent lung parenchyma Physiologic disturbances may be pronounced or totally absent depending on the amount of unoxygenated blood shunted into the systemic circulation. When significant amounts of unoxygenated blood are returned to the left side of the heart varying degrees of oxygen unsaturation occur

(1) Rev brasil. cir 24 751 62 November 1952
(2) Am. J Roentgenol. 70 183 10 August, 1953

in the systemic circulation. This results in cyanosis of varying intensity There is a stimulation of the erythropoietic elements of the marrow with a resultant polycythemic response There is no significant disturbance in the over all circulatory dynamics in cases of pulmonary arteriovenous aneurysms This is in contrast to changes seen in cases of congenital or acquired lesions in the systemic circulation. The pulmonary artery pressure is normally so low that the presence of a shunt in parallel does not significantly reduce the over all vascular resistance of the lung

The most common symptom was dyspnea, resulting from anoxemia Neurologic disturbances, usually transitory, were relatively frequent It is presumed that these episodes represent cerebral insults of varying intensity due to anoxemia or thrombosis and that polycythemia plays an important role Abnormal murmurs over the aneurysm, cyanosis and clubbing are frequent findings Telangiectasias or hemangiomas are also seen. There is usually elevated red blood cell count with proportionate elevated hematocrit and hemoglobin levels The typical lesion, on routine roentgenography, is a rounded or lobulated homogeneous density within the lung parenchyma, with relatively well defined borders and connected to the hilar region by cordlike bands Angiocardiography usually shows the nature of the process

Surgery appears to offer the only logical method of definitive therapy, it has been used in 44 of 85 cases reported in the literature Removal was undertaken in 41, and in 3 the feeder vessels were ligated There were four post operative deaths Indications for surgery have not been completely established The decision is most difficult in patients with isolated lesions if symptoms are minimal or absent and if there is no clinical evidence of a marked shunt, or in those with extensive and multiple lesions in whom successful therapy would necessitate removal of large segments of pulmonary tissue in several stages

Of 41 patients who did not have surgery, 20 lived Most had relatively mild symptoms Death seemed to be related to the pulmonary lesion in 11 of the 21 who died Of the 44 who had surgery 23 were appr cured

Benign Tumors of Lung Clement Price Thomas[3] (London) states that only 2% of lung tumors are benign and describes 41 bronchial adenomas, 10 hamartomas, 4 vascular and 2 endobronchial tumors

In bronchial adenoma, the condition of the bronchial tree beyond the tumor depends on degree and duration of obstruction and presence or absence of infection beyond the tumor Symptoms depend on the tumor itself, its mechanical effects and on infection, if any, beyond the obstruction. Radiologically, these tumors are detectable only when they obstruct the bronchus. Emphysema, atelectasis and infection may be produced. There were 26 females and 15 males with bronchial adenomas The larger bronchi, especially those of the lower lobe, were commonly involved. Most tumors were endobronchial but some were extrabronchial, probably originating from small bronchi. Histologically the tumors were composed of cuboid or spheroid cells which were regular in both size and staining properties and were usually arranged in columns or in acinar formation. Hemoptysis occurred in 22 patients, 4 had nonproductive cough, 1 a wheeze and 6 dyspnea. The commonest symptoms were due to infection. Of 23 with infection, 6 had dyspnea, 3 intermittent bronchial obstruction and 14 intermittent infections. Treatment included pneumonectomy in 12, lower lobectomy in 10, lower and middle lobectomy in 9, middle lobectomy, upper lobectomy and segmental resection in 1 each and local excision with bronchial reconstruction in 5 Follow up of 31 patients for 4-14 years revealed no recurrence except in 1 patient who had local resection and later pneumonectomy

Hamartomas are composed of tissues normally found in the lung In this series there were six interstitial and four endobronchial tumors They can be removed by local excision or segmental resection. Vascular tumors may be arteriovenous fistulas or hemangiomas Hemoptysis, polycythemia, cyanosis, and skin and/or mucous membrane telangiectasias are associated with these tumors. X ray may aid in diagnosis if large radicles of the pulmonary artery and vein are seen Segmental resection is the best treatment.

(3) Lancet 1 1 7 Jan. 2, 1954

Endobronchial fibroma projects as a lobulated mass within the lumen of a dilated bronchus. Both patients with this tumor were treated by lobectomy

Infection causes the greatest morbidity in cases of benign lung tumor If the tumors are recognized early, local removal is possible, without sacrifice of normal lung tissue, by resecting the endobronchial tumors with the portion of the bronchial wall from which they are growing and by enucleating tumors which occur interstitially and sewing up the defect The earliest x ray finding when the lesion is interstitial is a circumscribed mass Evidence of over and underinflation of parts of the lung may indicate endobronchial involvement Bronchoscopy is an aid to early diagnosis.

[It is curious that only those tumors of the lung which contain cartilage are called hamartomas. Actually there is just as much reason to give that name to the so-called bronchial adenomas. The term was coined in 1904 by Albrecht, a German pathologist, in connection with a tumor of the liver The word is derived from the Greek "hamartia," which means failure to reach the goal. In other words, it is a tumor which contains the normal elements of the tissue which have failed to develop in a normal way—Ed.]

Pulmonary Alveolar Adenomatosis Report of Case Diagnosed in Sweden is presented by Ulf Jacobaeus, Börje Olhagen, Ulf Rudhe and Birgitta Vestin[4] (Karolinska Hosp)

Woman, 34, pregnant, was thought to have bilateral cavitary pulmonary tuberculosis. She had been well until age 30, when she had a persistent cough and hoarseness and later bronchopneumonia. One year later a chest x ray showed a homogeneous parenchymatous opacity at the base of the left lung with ill defined, slightly polycyclic demarcation, moderate atelectasis and displacement of the mediastinum to the left. Tubercle bacilli were not found in the sputum. Cough and hoarseness persisted. About two years later an x ray showed bilateral mottled infiltrations of bronchopneumonic appearance, several cavities with fluid levels and a veil like opacity of the left lower lobe. Partial regression occurred with sulfonamide therapy She then had increased dyspnea, cough and copious sputum. Her general condition was good. The sputum increased in amount to 200 cc. daily and was mucoid, frothy and clear, nonpurulent and without blood. Chest films showed a moderate increase in the extent of infiltration in the left lower lobe and a large number of new opacities, chiefly nodular, in all lobes of both lungs. The lesions were poorly delineated and of variable size, with diameters of 2 mm. to 4 cm. The left lower lobe was completely infiltrated and atelectatic. Both lungs showed a few air-containing cavities, and around the left lung was a slight pleural thickening There was no evidence of invasion.

(4) Acta med. scandinav 145 278- 86 1953

Possible diagnoses were tumor, atypical sarcoidosis or mycosis. The sputum did not contain fungi or tubercle bacilli.

A diagnosis of pulmonary alveolar adenomatosis was later considered, but no typical cell formations of this disease were found in the sputum. The patient continued to have the same symptoms, and chest films showed progression of the lung changes despite treatment with antibiotics and corticotropin. She died after a downhill course.

At autopsy, the right lung showed rounded and coalescent tumor nodules and cavity formation, and the left lung, diffuse tumor growth. The bronchial tree contained no tumor, and there was no tumor invasion of the regional lymph nodes. In the affected parts of the lung the normal parenchyma was replaced by a solid tissue in which columnar and cuboidal cells formed small alveoli separated from each other by interalveolar septa of normal thickness. The alveoli were filled with a loose, weakly staining substance which contained variable quantities of round cells with abundant, loose cytoplasm. In some parts of the boundary zones between the tumor and the normal parenchyma cushions of columnar epithelium were found in otherwise normal alveoli. The final diagnosis was pulmonary alveolar adenomatosis.

[This disease is being found with increasing frequency throughout the world. Although in some fatal cases metastases are not found, in others they are. The condition therefore seems definitely to be a primary carcinoma of the lung, although a disease different from the ordinary bronchogenic carcinoma. Presumably it has no relation to cigaret smoking.—Ed.]

Bronchial Adenomas — Tumors with "Potential Malignancy" Report on Two Cases of Carcinoid and Two of Cylindromatous Variety is presented by V Ritama and L Ojala[5] (Helsinki) The patients were women, aged 32, 33, 33 and 51 All adenomas were in the vicinity of the bifurcation of the trachea Three patients complained at first of cough and breathlessness, and one complained of only breathlessness in a later phase Three had stridor in a late phase, two had intermittent attacks of hemoptysis, and two had chest pain In all cases the signs and symptoms of progressive bronchostenosis and its complications were later predominant.

In Case 1 the tumor was of the solid, carcinoid variety There were no signs of invasion In Case 2 the tumor was not fully solid, yet it showed a striking structural similarity with that in Case 1. In Case 3 the tumor, of the cylindromatous type, was in general well encapsulated, but there was abundant proliferation of tumor cells to neural lymph

(5) Acta path. et microbiol. scandinav 32 40 -419 1953

spaces and peripheral lymph node sinuses In Case 4 biopsies of the tumor, also cylindromatous and locally invasive, revealed evidences of increasing miosis. In the extrabronchial growths the histologic features of central areas approached those of oat cell carcinoma

In Case 1 symptoms had lasted 1½ years before the tumor was diagnosed bronchoscopically After electrocoagulation of the growth, the patient was symptom free for five years. In Case 2 the tumor had probably been present for 20 years or more, and the patient is alive though she has received no treatment. In Case 3 the growth was found at autopsy, and definite symptoms of bronchial tumor had appeared four years before death. In Case 4 diagnosis was confirmed by bronchoscopy after symptoms had been present for 1¼ years X ray and radium therapy was used The tumor responded, and follow up bronchoscopies revealed only scar tissue after both types of irradiation. However, despite maximal dosage, there were recurrences, and seven years after onset of symptoms, extrabronchial, apparently metastatic growths were present The findings at autospy suggested that irradiation did not affect the growth in the deeper layers of the original sites

Both the cylindromatous and the carcinoid type of bronchial adenoma arise in the glandular elements of the mucosa, though the area of origin of the cylindromas may be more extensive than that of the carcinoids This study shows that both types of bronchial adenoma have malignant potentialities. In this respect they seem to be rather remote from common bronchogenic carcinoma There is no sufficient reason for placing the carcinoid and cylindromatous varieties in different categories Differentiation into definitely benign and definitely malignant tumors, adenomas and carcinoma, based on the further course of the disease, does not reflect adequately the potentialities of the tumors of this group

Malignant Bronchial Papilloma Clinical Appearance and Pathology of Bronchial Adenoma is described by Alexander von Lutzki[6] (Univ of Basel) Malignant changes in a bronchial adenoma were seen in the following case

(6) Thoraxchirurgie 1 349-357 November 1953

Man, 65, had had dry cough and occasional pain in the left side of the chest for five months. No fever or hemoptysis was noted. Chest x-rays revealed a tumor at the left hilus. Tomograms disclosed extensive obliteration of the left upper lobe bronchus. At surgery a tangerine-sized firm tumor was found in the anterior segment of the left upper lobe. The whole lobe was resected. Microscopic examination revealed a larger bronchus obstructed by a papillary tumor which was covered partly by a layer of stratified squamous epithelium with occasional atypical mitotic configurations. In one area the tumor infiltrated the bronchial wall. The hilar lymph nodes were free from tumor tissue. The remaining lung tissue showed secondary changes due to bronchial obstruction.

Bronchoscopy and biopsy play an important role in the diagnosis of bronchial adenomas. It must be remembered, however, that occasionally biopsy may be misleading because malignant changes may appear first, as in this above case, at the base of the adenoma, not reached by the bronchoscope. For the same reason extirpation of the adenoma may not in itself be satisfactory. The treatment of choice is therefore lobectomy, although segmental resection may sometimes suffice.

[There is nothing new in the observation that such tumors may become malignant. Womack and I have been writing about this since 1938.—*Ed.*]

Experimental Production of Carcinoma with Cigaret Tar.—The increasing incidence of bronchogenic carcinoma and the available evidence relating smoking to it and possibly to cancer of other sites led Ernest L. Wynder, Evarts A. Graham and Adele B. Croninger[7] to investigate the carcinogenic effects of cigaret smoke on CAF_1 mice.

METHOD.—Tobacco tars were obtained fresh monthly from 50 cartons of a popular brand of domestic cigarets by "smoking" the cigarets in an apparatus designed to simulate human smoking habits as closely as possible. Average weight of residual tar was 9.7 Gm./200 cigarets. A 50% solution of tar in acetone was stored at −7 C. until used. On the shaven backs of 112 mice was painted the tar in acetone; 44 were painted with acetone alone. Doses of tar were gradually increased until after two months the doses averaged 40 mg. tar and acetone solution three times a week. An equal distribution of male and female mice was used. To determine the cocarcinogenic properties of croton resin in relation to tobacco tars, seven months after onset of painting, 31 of 102 surviving tarred mice and 14 of 42 surviving controls were given an additional painting per week of 1% croton resin in acetone. As this was extremely irritating, two months later a 5% solution of croton oil in mineral oil was substi-

(7) Cancer Res. 13: 855-864, December 1953.

tuted which, although less irritating, seemed to induce severe diarrhea. In a few of the animals with open ulcerating lesions a denicotinized solution was used until the lesions scabbed over As animals weakened with old age or disease, only the lesion was painted. Paint

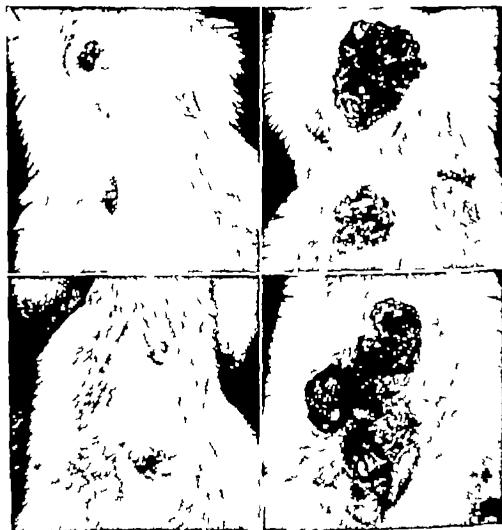


Fig. 42 (top left).—Early carcinoma (two lesions) at 540 days.
Fig 43 (top right) —Same animal. Advanced carcinoma at 590 days.
Fig. 44 (bottom left) —Early carcinoma at 494 days.
Fig. 45 (bottom right) —Same animal. Advanced carcinoma 605 days.
(Courtesy of Wynder E. L., *et al* Cancer Res. 13 855 864 December 1953.)

ing was discontinued when the lesions had become grossly positive carcinomas.

Of 81 tarred mice, 59% (26 females and 22 males) developed papillomas The first lesion was noted in the 33d week, with mean time of appearance 56 weeks Of 81 tarred mice 44 4% (25 females, 11 males) developed epidermoid

cancer The first lesion was observed in the 42d week, with mean time of appearance 71 weeks Seventy-one weeks constitutes approximately one half the life of CAF₁ mice, this corresponds roughly with the fact that in man, about 30-35 years of smoking (approximately one-half the life span) are required for development of bronchogenic carcinoma Of 62

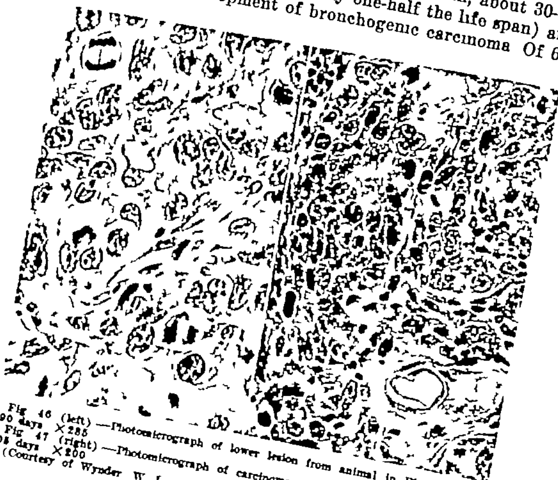


Fig 46 (left) —Photomicrograph of lower lesion from animal in Figure 43 at 590 days ×285
Fig 47 (right) —Photomicrograph of carcinoma from animal in Figure 45 at 608 days ×200
(Courtesy of Wynder W L et al Cancer Res 13 855 864 December 1953)

mice still alive at 12 months 58% developed cancer Of these 75% had previous papillomatous growths Localized thickening around the papilloma was followed by sloughing leaving an ulcerating crater which enlarged into grossly massive ulcers with definite rims (Figs 42-45) Histologic examination showed the usual characteristics of highly malignant epidermoid skin cancer (Figs 46 and 47) Two cancers in the tarred group were transplanted, one for 4 and one for 13 generations

Of 31 mice in the tar and croton oil group, 42% had papil lomas and 9 7% carcinomas These lesions did not appear earlier than in the group treated only with tar and evalu ations were impossible because 77% died between the 12th and 14th month.

Of the 30 painted with acetone alone, 30% were alive at the end of 24 months in contrast to 0% in the tarred group No lesions were noted and the epidermis remained soft and pliable Except for roughness and thickening of the epi dermis, no lesions developed in 14 mice treated with acetone and croton oil and 21% were still living at 24 months.

In another study, carcinomas developed within 4½ months in 25 mice painted with 0 3% methylcholanthrene in acetone three times a week. The first papilloma was noted at six weeks, the first carcinoma at 12 weeks Average time of appearance was 7 and 16 weeks

These studies establish condensed cigaret tar as a car cinogen for mouse epidermis and provide a tool to determine and isolate possible carcinogenic agents in that tar Studies now in progress to identify the carcinogenic fraction or fractions in cigaret tars may further knowledge of carcinogenesis and lead to practical preventive measures against cancer

[This study of course brings additional strong evidence that excessive cigaret smoking may be an etiologic factor in the production of bronchogenic carcinoma.—Ed.]

Carcinoma of Lung Erik Husfeldt[8] reports that the incidence of lung cancer in Denmark has increased while the incidence of pulmonary tuberculosis has decreased, and stresses the need for early diagnosis In 351 of nearly 600 cases of lung cancer seen from 1942 to 1952, analysis disclosed that the initial symptoms were acute infection, cough, dyspnea, chest pain, fatigue, fever, hoarseness, hemoptysis, epigastric pain or symptoms due to metastases The percent age of operability ranged from zero for hoarseness to 87 5% for lesions found by group x ray survey but causing no symptoms. Diagnosis of lung cancer depends on x ray projection in two planes, tomography, bronchography, bron choscopy, cytologic examination of the sputum with or

(8) Indian J Surg 15 135 149 September 1953

without exploratory thoracotomy Over all operability rate among the 351 patients, aged 26-78, was 26 7% The Copenhagen rate of operability in lung cancer has risen from 3 3% during 1943-44 to 20 9% during 1949-50 The more peripheral the tumor the higher the rate of operability

The operability rate in lung cancer was affected but little by the duration of symptoms before treatment, due chiefly to differences in rates of tumor growth. Among 126 pneumonectomies reported by Husfeldt for 1942 52, the operative mortality was 23 2% (34 3% for 1942-47 and 14% for 1950-51) The most important complications and causes of death were cardiac insufficiency, atelectasis and empyema, with or without bronchial fistula, all avoidable with careful surgery and postoperative care

Of 450 lung cancer patients (1949-50), 30% lived after pneumonectomy as against about 5 0% for the entire series

In Copenhagen the increase in incidence of lung cancer among men has been steep and real, regardless of changes in diagnostic means, and most pronounced among somewhat younger men, with the peak at age 57 during 1943-47 It is estimated that these men had been exposed to a carcinogenic agent before 1910 The exact cause of lung cancer is unknown, but inhaled cigaret smoke may well be a factor

Results of Lung Resection for Bronchogenic Carcinoma are discussed by Heinz Barthel [9] From 1947 to 1952, 450 patients with proved carcinoma of the lung were under treatment at the University Clinic in Hamburg Eppendorf. Surgery was performed on 195 patients (174 pneumonectomies and 21 lobectomies), 66 of whom died during or shortly after operation. Two thirds of the discharged patients died within six months From the 2d to the 5th postoperative year, mortality rate decreased rapidly In at least one fourth of the patients who died after the first postoperative year no metastases were found 24 6% of all patients operated on were still alive two of them four years and one five years after pneumonectomy Prognosis depends to a large degree on the type of malignant lesion Only a few patients with undifferentiated carcinoma survived

(9) Thoraxchirurgie 1 33 341 November 1953

[There is no doubt that the prognosis depends to a great extent on the type of carcinoma. A highly undifferentiated lesion is associated with a worse prognosis than a well differentiated tumor.—Ed.]

Cancer of Lung Analysis of 532 Consecutive Cases, seen between Apr 1, 1946 and Jan. 1, 1953, is presented by John H Gibbon, Jr., Frank F Allbritten, Jr, John Y Templeton, III, and Thomas F Nealon, Jr[1] (Jefferson Med. College) Histologic diagnosis was based on tissue examination in 484 and on the finding of cancer cells in the bronchial secretions in 48 Patients ranged in age from 30 to 79, most of them being between 50 and 69 There were 487 men in the series.

Common symptoms included cough, sputum, weight loss, pain, dyspnea, hemoptysis and weakness. Only 19 patients were seen before onset of symptoms In about 85% of cases the roentgenologist correctly made a presumptive diagnosis of bronchogenic cancer Exploratory operation was done in 380 cases In 24%, the preoperative diagnosis was made by bronchoscopic biopsy, in 45% by the finding of neoplastic cells in the bronchial secretions and in 31% on the basis of clinical symptoms and x ray findings alone In 205 cases (39% of the entire group), the cancer was extirpated at surgery The whole lung with the regional lymphatic system was removed in 190 cases, lobectomy or bilobectomy was done in 14 and local excision of the cancer was done in 1 case

Operative mortality of patients who underwent extirpation of the cancer was 22% The five year survival rate was 22% for patients whose cancer was removed and 9% for the entire series

Analysis of the present series as well as 17 series reported in the literature appears to indicate that the proportion of the total number of patients leaving the hospital alive with cancer removed is directly related to the proportion of the total number of patients in whom extirpation of the cancer is attempted.

Carcinomatous involvement of the recurrent laryngeal nerve usually indicates an inoperable cancer The extent of involvement by the tumor appears to be a significant factor

in the operative mortality This is most strikingly apparent in patients with contiguous involvement of the chest wall who have required block resection of the wall with the primary cancer

Bronchogenic Carcinoma Statistical Review of 234 Autopsies is presented by Raymond M Engelman and William L McNamara[2] (V.A. Hosp., Hines, Ill.) Bronchogenic carcinomas are defined as all primary pulmonary malignancies of epithelial origin arising from bronchi or their accessory glands The authors believe that the epidermoid and undifferentiated forms arise from the basal cell layer and the adenocarcinomas from the bronchial glands Included in the epidermoid group are the squamous cell type with and without pearl formation and the undifferentiated squamous cell type The adenocarcinomas include mucus- and non mucus-producing types The undifferentiated group, which is believed to be the most malignant, includes the so-called oat cell, round cell and small cell carcinomas They have found no carcinomas which met the criteria for so-called alveolar cell carcinoma

Metastases may occur as a result of (1) lymphogenous spread, (2) hematogenous spread, including the vertebral veins, (3) direct extension (4) implantation following surgery, and (5) bronchogenic spread There is a greater tendency to dissemination by blood vessel invasion than in carcinomas elsewhere

In the present series there were 61 6% epideroid carcinomas 8 9% adenocarcinomas and 29 06% undifferentiated types The right side was more frequently involved (58 9%) than the left The peribronchial lymph nodes were involved in 53 85% of cases (55 56% epidermoid, 9 52% adenocarcinoma and 34 91% undifferentiated) the mediastinal lymph nodes including the peritracheal, in 41 88% (55 10% epidermoid 10.20% adenocarcinoma and 34 69% undifferentiated) the abdominal nodes, including the retroperitoneal, in 17 95% and the cervical nodes in 7 69% The liver was involved in 38 46% of cases

There were adrenal metastases in two of every five cases renal metastases in one of every three and bony met

(2) J Thoracic Surg 2 2 3 March 195

in one of every six. The lung was involved in 1 of every 7 and the brain in 1 of every 12 cases

Organs involved in fewer than 10% of cases were pancreas (7.26%), spleen (5 55%), skin (3 41%), bowels (2 13%), prostate (1.28%), diaphragm and thyroid (0 85%) and testis and gallbladder (0 43%)

[The high incidence of adrenal metastases found by the authors agrees with the findings in many other series of autopsies. It is a curious and unexplained phenomenon to which Bosquet called attention about 25 years ago It seems doubtful that the tendency to make the operative removal of the cancer more radical by extensive dissection of the mediastinum is worth while in view of the frequent early blood borne metastases.—Ed.]

Surgical Management of Tumors of Lung Discovered in X ray Surveys Brian B Blades[3] (George Washington Univ) states that chest surveys for tuberculosis have revealed a significant number of lung tumors Semiannual full sized roentgenograms of the chest, both frontal and lateral projections, offer the best method for early detection of lung neoplasms

It is impossible to differentiate benign from malignant tumors by x rays Coin shadows in the lungs usually represent a tuberculoma or a lung neoplasm, but a metastatic lesion must also be considered In patients under 40 coin shadows are more apt to represent tuberculoma, in those over 40, the incidence of neoplasms increases Calcification may be present in both tuberculomas and tumors The location of the coin lesion near a pleural surface is only suggestive of tuberculoma Adenomas, xanthomas and other less common lung tumors may produce a clearcut coin type shadow The size of the lesion is not an indication of its microscopic character Hilar shadows may be the result of enlarged mediastinal lymph nodes from tuberculosis sarcoid disease or inflammation of any type Atelectasis of the entire lung or a lobe may or may not produce symptoms Atelectasis may cause emphysema of a lobe or lobes A tumor and tuberculosis may occur together especially in older patients Bronchiectasis and lung abscess may be confused with neoplasms Lung cancer may be confused with viral pneumonia Lung cancer may remain indolent for months or even years therefore, a stationary, silent lesion that does not change in

(3) J.A.M.A. 154 196-198 Jan. 16 1954

configuration during a period of observation does not rule out cancer of the lung The exact diagnosis must be made by microscopic examination of tissue

Case of Spontaneous Regression of Untreated Bronchogenic Carcinoma. Brian Blades and Robert G McCorkle, Jr[4] (George Washington Univ) report a case

Man, 59 seen in May 1947, about nine months previously had noted an increase in a cough which had been present for years. There was a history of malaise and increasing dyspnea for two months and an 18 lb weight loss over six months. He had suffered from chronic bronchitis for 20 years, had smoked two to three packages of cigarets daily for years and drunk heavily for 25 years. There were decreased breath sounds over both lung bases, and an x ray revealed an opacity in the right lung field anteriorly at the third and fourth intercostal spaces. Bronchoscopy was not revealing. The x ray appearance did not change in eight weeks, and exploration disclosed a carcinoma of the lung with hilar involvement and mediastinal invasion at the level of the inferior pulmonary artery. The chest was closed. Biopsy revealed epidermoid carcinoma. The postoperative course was uneventful, and x rays showed progressive clearing of the pulmonary lesion In May 1952, the patient was readmitted and his entire life history re-evaluated. Nothing significant was found except exposure, as a linotype operator, to noxious fumes for four to five years. Results of blood chemistry studies and agglutination and liver function tests were within normal limits. Ketosteroid excretion was normal for a man of his age. A chest x ray showed almost complete disappearance of the original lesion and a 3 cm. irregular density in the left second interspace anteriorly A destructive lesion was demonstrable in the occipital bones. An x ray of the chest in December 1952 showed no change from that obtained in May 1952.

[Remarkable latency and even spontaneous regression of cancer are rare but well known phenomena.—Ed.]

Blood Supply of Malignant Pulmonary Neoplasms L Cudkowicz and J B Armstrong[5] (Postgrad Med School, London) examined the bronchial arteries in five human beings with malignant pulmonary neoplasms by postmortem injection of radiopaque material In four cases of bronchial carcinoma the pattern of bronchial arteries was diffuse and proliferative and extended to the tumor Large dilated lacunae deriving from the bronchial arteries were seen in the tumors In two cases, metastatic lung tumors had produced no corresponding changes in the bronchial arteries

---

(4) J Thoracic Surg 27 416-419 April, 1954
(5) Thorax 8 15 156 June 1953

Bronchopulmonary anastomoses were seen in two cases of primary bronchial neoplasm with hypertrophic pulmonary osteoarthropathy

Hemoptysis in such cases of pulmonary neoplasm originates from the bronchial arteries, since large and thin walled lacunae found in the tumor substance had continuity with enlarged bronchial arteries

Localization of Radioactivity in Lung and Lymph Nodes J Ray Bryant, Harold F Berg and William M. Christophersen[6] (Univ of Louisville) experimented with methods of delivering effective radiation limited to specific segments of the lung and regional lymph nodes in order to find palliative treatment for inoperable lung cancer Radioactive colloidal gold (Au^{198}) was instilled through a catheter into a selected segment of a lung in 20 dogs Assay of the dogs, killed at various intervals, revealed localization of activity within the segment of lung and regional lymph nodes Histologic studies showed radionecrosis in proportion to the amount of isotope instilled in the lung segment Only minor changes were seen in lymph nodes Colloidal Au^{198} was injected through a needle into the mucosa of the intermediate bronchus of eight dogs Assay revealed extremely high levels of concentration of radioactivity in the regional lymph nodes, a lower level at the site of injection and negligible activity elsewhere

Maximal localization was achieved by the instillation method. A skilled bronchoscopist should be capable of localizing the segment of lung to which the isotope is to be delivered. The injection method produced extreme localization in the hilar lymph nodes with levels even higher than at the site of injection. A combination of the two methods may be the means of delivering palliative radiation in cases of far advanced lung cancer If the lymphatics are "plugged" with metastatic emboli, localization in the lymph nodes may not be as concentrated or may not result at all

Stress in Pulmonary Tuberculosis I. Thorn Test and Circulating Eosinophils in Surgical Patients were studied by Alfred Goldman, L. Alfred Breckler Eric Stern and Robert

(6) J Thoracic Surg 26 21 23 September 1953

Robison[7] (Duarte, Calif) The Thorn test is a determination of the percentage drop in circulating eosinophils after corticotropin administration, and a fall of less than 35% is evidence of lowered adrenal reserves Of 110 patients with chronic pulmonary tuberculosis, 25 had values below 35% with this test. Of 81 undergoing pneumonectomy, limited resections or thoracoplasty, 19 had low values. Of 59 patients with uncomplicated postoperative courses, only 7 had values below 35%, whereas of 22 with postoperative complications, 12 had low values Only 16% of patients with values over 35% had complications The preoperative Thorn test appears to be one of the aids, when taken in conjunction with other clinical and laboratory findings, for assaying the ability of patients with chronic pulmonary tuberculosis to withstand surgery

The percentage fall of circulating eosinophils postoperatively indicates the severity of the "stress reaction," and the duration in days of eosinophilic fall indicates the duration of stress The mean percentage fall in eosinophils after pneumonectomy, limited resection and first stage thoracoplasty was the same in both the complicated and uncomplicated cases except that the fall lasted longer in the former Second stage thoracoplasty produced a significantly more prolonged adrenal stress response than the other types of surgery

[If, after a more extensive trial, this procedure seems to help in deciding the operability of a patient with pulmonary tuberculosis, it will certainly be most valuable. The most one can say now is that only time will tell.—Ed.]

Immediate Results of Thoracoplasty with Pulmonary or Pleural Indications in Pulmonary Tuberculosis (Based on Statistics of 1,500 Cases) The benefits of streptomycin therapy in the surgical treatment of pulmonary tuberculosis although most spectacular in operations for lung removal or resection, have also been noted in thoracoplasty, according to M Bérard[8] (Lyon) A review of 1,546 thoracoplasties performed between April 1948 and January 1953 covering only the surgical phase of the procedure (i e, the results of the first three postoperative weeks) disclosed a total mor

(7) Dis. Chest 24 603-618 December 1953
(8) Lyon chir. 48 5 0 526 July 1953

tality of less than 1% Among patients with pulmonary indications (1,430), the mortality rate in the first three weeks was only 0 3%, among those with pleural indications (116), it was somewhat higher, but since two of the four deaths in this group were deemed preventable, thoracoplasty may be considered almost as harmless for patients with pleural involvement as for those with pulmonary lesions

The danger of fatal postoperative dissemination of tuberculosis, which used to be one of the principal risks in thoracoplasty, has been virtually eliminated by the use of antibiotics Although many patients in this series were aged or had bilateral lesions, fewer than $\frac{1}{1,000}$ died of immediate respiratory insufficiency The author believes that thoracoplasty can properly be selected without preliminary functional examination, because a mistaken or pessimistic interpretation of the results of such an examination might needlessly deprive the patient of the benefits of the intervention Pulmonary embolism was never encountered among the 1,430 patients with pulmonary indications. Paradoxically, postoperative pulmonary complications (infarct, suppuration and atelectasis) are exceptional in surgical collapse therapy for tuberculosis

A one stage procedure was sufficient in nearly half the patients, even in patients with extensive lesions, adequate collapse was secured by thoracoplasty in two stages more than 9 of 10 times With few exceptions, the author adhered to the principle of not resecting more than 5 ribs at one time in patients with pulmonary indications, in patients with pleural involvement, however, he often extended the operation to include 9 or 10 ribs at a single stage, thereby avoiding multiple interventions and securing much better effacement of the pleural cavity Total thoracoplasty can safely be carried out in these patients with the aid of adequate oxygenation through closed circuit anesthesia and replacement of lost blood by transfusion during the procedure

[Splendid results, which would have been impossible without streptomycin. I am not so sure, however that it is wise to omit completely the respiratory functional tests in the aged patients.—Ed.]

Thoracoplasty and Resection for Pulmonary Tuberculosis F A. Hughes, C C Lowry and J W Polk[9] (Memphis, Tenn.) report on 111 consecutive patients who had posterior apical thoracoplasty and 131 who had a pulmonary resection for tuberculosis between January 1947 and October 1951, all were followed to Mar 31, 1952 Of those who had resection, 82%, and of those who had thoracoplasty, 68% were aged 20-40 There were only two women in both groups Nonprogressive cavitary fibrocaseous disease was present in 96% of the thoracoplasty group and 79% of the resection group

Streptomycin was not used routinely for the thoracoplasty group but was used daily in one group with resection and twice a week with daily PAS in the second group

There was a 60 day mortality rate of 1 5% for resection and 1.8% for thoracoplasty There were 251 thoracoplasty stages performed with a mortality of 0 8%/stage. Total fatality was 4.6 patients for thoracoplasty and 3 5 for resection for each 100 patient years of observation. Operative spreads occurred in 9% of patients treated by thoracoplasty and in 7 4% of those with resection Late spreads occurred in 29.3% of the thoracoplasty series and in 18% of those with resection Fistula and empyema have not been as troublesome since better technic has been used in doing segmental resections and in closing the bronchial stump After resection, 79% of patients are inactive, compared with 64% after thoracoplasty Resection was subsequently done for 10 patients treated by thoracoplasty

The difficulty in obtaining good results in nonwhite patients and in patients with extensive or unstable disease conforms with the usual experience

The percentage of patients at home is slightly greater and the percentage dead less for patients treated by resection. Approximately 20% of both groups are working, and approximately 20% are in a hospital.

Resection has been elected as a preferable procedure with increasing frequency Intermittent streptomycin, 1 Gm. weekly, with daily PAS has been used with 67 patients with

(9) J Thoracic Surg 25 434-46 May 1953

better results than was obtained by short courses of 1 Gm streptomycin daily at the time of resection.

[Nine per cent of spreads after thoracoplasty seems high in this age of streptomycin. See the preceding article by Bérard.—Ed.]

Results of Thoracoplasty Follow up of 583 Patients Robert Laird[1] reviews a two to eight year follow up of 583 patients treated by thoracoplasty for tuberculosis The chief indication for operation was persistent open cavity or active tuberculosis in the upper half of one lung The operation performed was the usual thoracoplasty There were 1,404 operations Atelectasis followed general anesthesia more frequently than local. The usual hospitalization time after thoracoplasty was six months

After successful thoracoplasty there is a good chance of the disease's remaining inactive in five of six patients Of 122 patients discharged with positive sputum, but with the tuberculous lesion improved, 60% became quiescent, 80% could return to work. Mortality rate for the entire series was 7% Of the group followed five years, 88% were alive, 72% were quiescent and 74% were working Of 166 patients with contralateral pneumothorax at the time of operation, 27 had respiratory embarrassment in the early postoperative period Mortality rate was 8%

Pulmonary tuberculosis is a disease of early adult life, 70% of the patients were 20-35 The results in patients aged 50 or more were not so good as in younger ones, but thoracoplasty in older people is of definite value and not too hazardous.

There is no doubt that resection is best for certain cases of advanced tuberculosis, e g, destroyed lung or stricture of the larger bronchi. Thoracoplasty versus lobectomy or segmental resection in the treatment of upper zone disease is a more difficult problem. Thoracoplasty should be looked on as a stage in treatment, and every effort should be made to improve the tuberculosis before operation

Indications for Segmental Resection in Pulmonary Tuberculosis, Based on Study of 450 Patients Operated on (400 in New York City and its environs and 50 at Strasbourg), are discussed by E Forster, Ch Daniels and J M Oham

(1) Lancet 2:319-322 Aug 15 1953

berlain.[2] Experience with these patients, who were drawn from all classes of society and at Strasbourg included North Africans as well as Europeans, showed that segmental resection may be expected to yield good results in five types of cases These are (1) tuberculomas or certain filled cavities clinically and radiologically indistinguishable from them, (2) cases in which thoracoplasty has failed, (3) cases in which collapse therapy cannot succeed because of the character of the lesions, (4) certain emergencies, such as pleuropulmonary perforations or rupture of emphysematous bullae, which require active and rapid treatment, and (5) cases in which, although prolonged collapse therapy would probably result in cure, the cost in loss of function would be too great.

In the first type, segmental resection is generally accepted as the preferred treatment A thorough clinical and radiologic study of the patient should be made before operation of any kind is decided on, and esthetic and social factors should also be considered Collapse therapy, besides causing deformity, often has an adverse psychic effect on the patient which can be avoided by segmental resection. Patients with lesions in the upper right lobe for which lobectomy is required may also have lesions in the upper segment of the lower lobe, and in such cases a Fowler segmental resection associated with upper lobectomy will often prove superior to thoracoplasty The same procedure, however, is not advisable when the left lung is involved, because the more extensive loss of parenchymatous tissue leads to too great a functional deficit. A special indication for segmental resection is also found in contralateral lesions, one of which may be removed by resection and the other treated by collapse or local exeresis In planning treatment of this kind, the major focus should be dealt with first, because sometimes the lesser lesion will have healed before it is time for the second procedure Finally, excellent operative results are sometimes obtained by segmental resection when the tuberculous lesions, though separated are confined to a single segment of the lung or occur in a wedge-shaped area The optimal time for surgery is when expectoration has been re

(2) Presse méd. 61 1641 164° Dec. 12, 1953

duced to a minimum. Respiratory insufficiency and excessive dissemination of the disease are the principal contraindications. If either is discovered during operation (as a consequence of having misinterpreted the radiographs), a change in procedure is necessary

Follow up on 300 of the patients after one to five years showed that 93 7% of the survivors were well, i e., their sputum was bacteriologically negative and they were either working or capable of normal physical activity Operative mortality was only 3%

Experience with 350 Total Pneumonectomies for Tuberculosis Late Results M. Bérard, R Arribéhaute, J Germain and J Dumarest[3] (Lyon) report that of 350 patients operated on between Jan. 1, 1948 and Jan 1, 1953, 207 had excellent results Thirty-eight were still under treatment for bronchial fistula or empyema, or contralateral disease had developed. Six were lost to follow up, and 99 had died, 23 of early cardiopulmonary complications and 76 of late pleuropulmonary complications (34 of bronchial fistula, 20 of pleural empyema and 22 of contralateral disease) The high mortality in this series does not warrant pessimism regarding pneumonectomy, because it includes patients operated on at the beginning of the authors' experience with this procedure when complications may have arisen as a result of errors in technic or poor selection of patients, in many cases pneumonectomy was performed because it seemed to be the last and only treatment available Comparison of results obtained when indications were optimal (bronchial stenosis) with those obtained when they were most unfavorable (a damaged lung in 180) emphasizes the fact that prognosis depends essentially on the severity of the condition at the time of operation. Thus of 180 patients with damaged lungs, 30% died and 56% had excellent results, whereas of 35 with bronchial stenosis, 6% died and 94% had excellent results

The success of total pneumonectomy is largely determined in the first postoperative year Patients who survive this period without accident virtually run no further risk of empyema or bronchial fistula and those whose tubercu

(3) Rev tuberc 17 641 650 1953

losis is confined strictly to the lung removed need have practically no fear of later contralateral disease

Prognosis for the Contralateral Lung after Resection for Pulmonary Tuberculosis M R Geake and F H. Young[4] (Brompton Hosp., London) studied the records of 101 patients with pulmonary resections for tuberculosis who survived the immediate postoperative course (three months) In only 11 was the contralateral lung considered unsatisfactory Of the six who died after the postoperative period, five had satisfactory contralateral lungs Of the 95 patients who survived, 72 were followed for two years, only 1 had rather doubtful spread of disease after 15 months, the minimum follow up period Deterioration was noted, within 6 months in two patients, and within 12 months in eight.

Deterioration in the contralateral lung, if related to the resection, will probably appear within 12 months Deterioration was most common if unfavorable changes had occurred in the 12 months preceding the operation. Patients with little or no sputum had less spread of disease than those with a large amount of sputum. There was no evidence that the duration or extent of disease in the resected lung had any appreciable influence on the contralateral lung

Pneumonolysis with Plastic Prosthesis Nature and Indications L. Adelberger and H Serdarusitz[5] report on their experiences with a procedure to collapse the lung by subperiosteal resection of the first to fourth ribs and simultaneous extrapleural pneumonolysis Collapse was maintained with a new plastic filling, polystan. Histologic study has proved that it causes no irritation and that capsule formation takes place around it

METHOD—A curved paravertebral incision is made midway between the scapula and the spinous processes behind the scapula to about the 7th rib in the posterior scapular line. The incision goes through the skin and the lower third of the trapezius and rhomboid muscles. Subperiosteal resection of two-thirds the length of the 4th rib is followed by exposure of the upper part of the back of the thorax The upper lobe is freed extrapleurally—medially to the aortic arch, anteriorly to the lower edge of the 1st or 2d rib posteriorly to the lower edge of the 6th-8th rib—depending on the extent of the process In subperiosteal resection of the 2d and 3d ribs

(4) Thorax 8 104 108 June 1953
(5) Thoraxchirurgie 1 101 116 June 19 3

for three-fourths their length and of the 1st rib to the cartilage, the muscles and periosteal sheaths are spared. The paravertebral stumps are not shortened too sharply The transverse processes are not resected, therefore no scoliotic deformities or sinking of the shoulder girdle follows. Drainage and clamping are done at the lowest point. Polystan is inserted on the preserved muscle and periosteal sheaths which are fixed with catgut or silk sutures along the musculature of the spine medially and caudally on the 5th rib Penicillin and streptomycin are instilled into the pneumonolysis cavity and primary closure is done in layers. Penicillin and streptomycin are given in usual dosages intramuscularly for eight days postoperatively

Of the 70 patients in this series, 26 underwent pneumonolysis by thoracoplasty, 43 pneumonolysis with plastic filler thoracoplasty and in 1 case the polystan was inserted secondarily after extrapleural pneumonolysis Patients ranged in age from 20 to 56 years The disease was of varying severity, some had multiple cavitation and 23 had bilateral cavitation. Early results (between operation and four to six weeks postoperatively) showed normal sputum in 49 of 70 patients, in 19 it remained positive Postoperative complications included slitlike cavities in eight patients, six with homolateral spread and one with contralateral exudative pleurisy No postoperative bleeding was encountered There were one patient each with early specific infection of the filled cavity, with nonspecific infection and with lung fistula Three deaths were due to heart and circulatory failures

Two to three years postoperatively 44 patients had normal sputum and 17 were employable In three patients there was progression of old contralateral lesions

[It is interesting that although more articles are appearing in the foreign literature advocating the use of plastic material for compression in pulmonary tuberculosis, American workers on the whole seem to be unenthusiastic. Probably the difference in attitude is due largely to the late complications, even 12 15 years after the operations, which have been seen by the older thoracic surgeons in this country The younger European surgeons who have taken up this work only recently have not had time to see the bad results of the introduction of this foreign material into the tissues.—Ed.]

The Polystan Sponge as Plombage Material in Collapse Operations for Pulmonary Tuberculosis and in Stabilizing the Mediastinum Following Pneumonectomy According to

Jens L Hansen and Harald Engberg[6] (Copenhagen), of two types of plombage material used in the surgical collapse therapy of pulmonary tuberculosis, one has a smooth, continuous surface (Lucite balls) and the other a smooth, discontinuous surface and spongelike structure (the polystan sponge)

The discontinuous, porous surface of the polystan sponge allows ingrowth of connective tissue and consequently solid fixation of the inert material in surrounding tissues This solid fixation of the sponge to the tissues in contrast to the lack of fixation of Lucite balls makes the sponges better material for plombage and reduces the risk of complications

Two fundamentally different anatomic sites have been used for insertion of such material, the extrapleural and extraperiosteal (thoracoplasty principle) The extraperiosteal insertion of inert material is far more reliable than the extrapleural, as it avoids the risk of cavity necrosis In this method the ribs preserved without periosteum serve to hold the polystan sponge over the lung to secure permanent collapse The superficial wall of a tuberculous cavity in the lung is partly supplied by blood from intercostal vessels through adhesions between the chest wall and lung In extrapleural pneumonolysis the connection between the chest wall and lung is severed, with consequent risk of cavity necrosis, bronchial fistula and tuberculous empyema In extraperiosteal pneumonolysis, blood supply and parietal lymph drainage to the tuberculous cavity in the lung are maintained The bony thorax and the intercostal bundles constitute a natural barrier against the progress of the tuberculosis.

Extraperiosteal polystan plombage is planned on the basis of roentgen study and the extent of collapse is estimated as in thoracoplasty Operations are usually done under general anesthesia. A standard thoracoplasty incision is made, but the ribs, denuded of periosteum, are preserved. The lung remains covered by a continuous layer of intercostal muscles and periosteum Apicolysis is carried out and the plombage material is inserted after the removal of one rib or the

(6) Acta chir scandinav 105 335 349 1953

division and later fixation of one rib The fillings are inserted between the apex of the lung and the denuded ribs. The size and shape of the material may be adapted as required during the operation. Management after surgery consists of antibiotic therapy directed against tuberculosis and used as a prophylactic measure against pyogenic infection for four to seven days

In 80 cases of pulmonary tuberculosis with cavitation, extraperiosteal pneumonolysis was performed in a total of 90 extraperiosteal operations The procedure was used mainly in the poorest surgical risks 79% were deemed unfit for any other form of surgery, and 42% had severe bilateral lesions There was no postoperative mortality or complication. After 12-18 months, 3 of 52 patients followed had staphylococcic space infection. Tuberculous infection and bronchial fistula in two instances were due to operative injury to the cavity and to the capsule of the filling in the course of secondary pulmonary resection for residual cavity During follow up, 66% of the patients were well and sputum was negative, 26% still had positive sputum and 8% had died More than half of the patients who had not recovered had severe contralateral unoperated lesions, present at the time of extraperitoneal pneumonolysis

In 25 cases of pneumonectomy, the lung prostheses of polystan sponge were used for stabilization of the mediastinum In 24 of these the prosthesis was inserted intrapleurally immediately after pneumonectomy, whereas in one case it was inserted extraperiosteally after 14 days The insertion of the prostheses was followed by empyema without bronchial fistula in five instances, principally after pneumonectomy for suppurative or tuberculous lung disease After a year or two the volume of the prosthesis had diminished somewhat

[Of course this material is a foreign body and the chances are that the tissues will try to extrude it as they do any foreign body The authors should give us another report five years from now However, if it has arrested tuberculosis in a patient who is a very bad risk for any other type of surgical treatment, it may have been worth while because perhaps later a thoracoplasty or resection of some kind may be carried out.—Ed.]

Bronchial Resection and Anastomosis. Paul W Gebauer[7]

(7) J Thoracic Surg 6 41 260 September 1952

(Honolulu, T H.) believes that in all cases of isolated tra cheobronchial disease and in many that are combined with pulmonary parenchymal disease, some type of tracheobron chial surgery should be routinely considered Sixteen cases illustrating some aspects of the technical application of bron

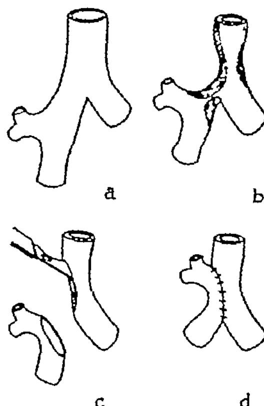


Fig. 48 —Line diagrams of tracheal bifurcation depicting operative procedure used for combined, severe tracheal and right bronchial stenosis. Chest x rays showed no abnormality or disease of lung fields. *a*, normal bifurcation for comparison. *b*, healing tuberculous tracheal stenosis, most severe in lower third, was by-passed with long tracheotomy tube; right bronchus was nearly occluded. *c* stenosed right bronchus has been excised: distal bronchus is a large double-barreled structure tracheal bronchus is being slit open. *d*, tracheal circumference has been enlarged by transplantation and suture of right bronchus into tracheal incision. (Courtesy of Gebauer P W: J Thoracic Surg 26 41 260 September 1953)

chial resection to a variety of tracheobronchial lesions are presented

For healed tuberculous strictures involving the right up per lobe bronchi, sleeve resection and anastomosis were done in three cases with simple end to-end closure with fine wire rather than everting mattress sutures, in the early postop erative period the suture line was kept clean by means of

bronchoscope In two similar stricture cases, the right bronchus from the middle lobe stump to the coryna was resected with anastomosis between the distal trachea and lower lobe bronchus In two patients with dermal grafts inserted more than two and three years earlier for correction of main bronchial stenosis, recurrent tuberculous tracheobronchitis was treated successfully by partial excision of the grafted main bronchi and upper lobe stumps In one patient with primary tuberculosis and intermittent obstructive emphysema, resection and anastomosis of the upper lower lobe bronchial crotch to the trachea was performed successfully despite the unquestioned presence of active tuberculous lymph node and bronchial inflammation. In one case, an adenoma arising at the main crotch of the stem bronchus was excised, converting the three divided bronchi into a single stump which was anastomosed to the proximal stump of the stem bronchus

At the time of upper lobectomy for atelectasis of the right upper lobe and physiologic occlusion of the bronchus by dense scar that incorporated the orifice of the right main bronchus at the coryna, the upper lobe bronchus and adjacent stem of bronchial scar were excised as a wedge and the lower edge rotated up to meet the upper Large bronchial defects, involving less than half the bronchial circumference can sometimes be closed transversely Closure is sometimes simplified by sacrificing a neighboring lung segment and using its bronchial stumps as a crude flap

Complete or partial bronchial division to facilitate dissection is of particular importance in salvage of an intact middle lobe when its bronchus is more or less fused to the branch bronchi of a shrunken, atelectatic and bronchiectatic lower lobe If the bronchus is first divided below the upper lobe, the middle lobe bronchus (to be preserved) can be more easily and safely separated from the lower lobe basal bronchi and the middle lobe is then joined by anastomosis to the proximal right bronchial stump This was done twice

One patient given antimicrobial treatment for recurrent, severe ulcerocaseous tuberculosis of the trachea and right bronchus had asphyxiating stenosis during the early healing phase Ten days after tracheotomy with a long cane-shaped

tube to by pass the stenosis, operation by the procedure shown in Figure 48 was undertaken. The distal line of excision of the right bronchus was across both upper and lower lobe bronchi, creating a double barreled structure The lateral tracheal wall was incised longitudinally 3-4 cm up from the proximal line of excision at the coryna. A narrow strip of fleshy, edematous tissue was excised from the anterior margin of the lateral tracheal wall, the trachea spread open and anastomosis performed The postoperative course was uneventful, and the short tracheotomy tube was removed after one week.

[Gebauer has made a very important contribution in developing technics for plastic repair of bronchi which conserve lung tissue.—Ed.]

THE THORAX AND MEDIASTINUM

Reconstruction of Benign Nontuberculous Strictures of Trachea. W C Sealy, R. L. A. Keeley, J P Collins and C R Stephens[8] (Duke Univ) treated two patients by the Gebauer method using a dermal graft Preoperative tracheotomy made daily visualization in both patients possible

CASE 1.—Girl, 19, had had epidermolysis bullosum for 15 years and for the same time had worn a tracheotomy tube following severe laryngeal infection. There was steady increase in respiratory distress. X rays showed obstructive emphysema of the left lung Planigrams revealed tracheal stenosis beginning just below the end of the tracheotomy tube, extending to the carina and involving the left stem bronchus. Under surital,* nitrous oxide, oxygen and ether the trachea and stenosis were exposed through a right thoracotomy The airway was maintained by passing a catheter into the trachea through the tracheotomy opening This tube became plugged, necessitating opening the trachea with the passage of a catheter into the right main stem bronchus. The heart stopped beating but was revived by massage. The trachea was incised longitudinally, opening completely the strictured area. A dermal graft was fashioned to fit the defect, stiffened with no 28 stainless steel wire and sutured to the tracheal and bronchial wall with silk. Concretions of blood and mucus were aspirated until, three weeks later, a larger tracheotomy tube was inserted and numerous inflammatory polyps and granulomas excised. The graft was viable. After six months there was no respiratory distress and the graft could not be distinguished from the remainder of the tracheal wall

---

(8) Ann. Surg 138 99 103 July 1953

CASE 2.—Man, 52, had had a laryngectomy 3½ years previously for a lesion originally thought to be carcinoma. The lesion was later found to be caused by Blastomyces dermatitidis. Subsequent ulceration around the tracheostomy healed after stilbamidine therapy Lipiodol® instillation showed a markedly narrowed trachea from the end of the tracheotomy tube to within 1 cm. of the tracheal bifurcation. The trachea, exposed through a right posterior thoracotomy, was opened from the end of the tracheotomy tube to the tracheal bifurcation. A dermal graft was fashioned to fit the defect, stiffened with stainless steel wire and sutured in place with silk. The graft was unusually thick. The wire and graft were extruded about six weeks postoperatively, leaving the lumen of the trachea covered with epithelium except the middle of the previously grafted area. The patient was asymptomatic six months later

The graft in Case 2 was probably too thick. A thin full thickness graft or split thickness graft in instances of unusually thick skin that includes the epidermis should be the material of choice in the repair of a fibrous stricture of the trachea. Removal of the epidermis leaves a raw surface that is an excellent place for the trapping and accumulation of debris and secretions Wire for stiffening may not be necessary in all cases.

Resection and Anastomosis of Intrathoracic Trachea for Primary Neoplasms is preferred by Joseph E Macmanus and Robert McCormick[9] (Buffalo), although plastic methods must be developed for individual cases Segmental sleeve resection with end to-end anastomosis is preferred to partial resection.

Man, 61, had repeated colds for a few months and hemoptysis on two occasions. Chest x rays revealed no abnormality but bronchoscopy disclosed a 2.5 cm. mass on the anterior wall of the trachea 2 cm. above the carina. Biopsy was interpreted as primary carcinoma of the trachea. Physical examination and laboratory findings were not significant. He smoked 10 cigarets daily

At operation the chest was opened and the 5th rib resected. The azygos vein was divided between silk ligatures and the mediastinal pleura opened to the apex of the chest. Posterior mediastinal lymph nodes were dissected from the level of the subclavian artery down on both sides and removed. The trachea was mobilized, turned 180 degrees to the left and opened through the membranous portion just below the tumor The intratracheal tube was quickly inserted into the left main bronchus and its cuff inflated with good respiratory exchange. A sleeve resection, involving three rings anteriorly and measuring 3.5 cm. vertically, was performed. The tracheal walls

(9) Ann. Surg 139 350-354 March, 1954

were united with 000 sutures and a section of fascia lata was passed around the anastomosis, carried up on the trachea to the inlet and down to the bifurcation of the main bronchi and snugly sutured in place, providing an air tight anastomosis. The mediastinum and chest were closed, and extrapleural drainage was provided for the mediastinum. A tracheotomy was performed. The postoperative course was uneventful except for loculated pleural effusion which responded to repeated aspiration. The tracheotomy tube was removed on the 17th day, and bronchoscopy showed almost complete epithelization with no apparent narrowing. The patient was entirely well 20 months after operation. Microscopic diagnosis was cylindroma which grew down to but did not invade the cartilage. Lymph nodes were not involved.

Important features in sleeve resection with end to-end anastomosis are (1) adequate mobilization of the trachea, (2) adequate control of anesthesia with control of respiration of at least one lung, (3) sharp, accurate section to allow later snug, accurate apposition (4) support of the suture line with fascial graft, and (5) complementary tracheotomy to reduce tidal air, protect the suture line and allow easier aspiration of secretions

[This condition was formerly hopeless. It is gratifying that the new methods can give results like this.—Ed.]

Benign Neurogenic Tumors of Chest Wall. Lew A. Hochberg and Laurence M. Rivkin[1] (Brooklyn) note that among approximately 200 benign intrathoracic neurogenic tumors recorded in the literature, there were only 18 chest wall tumors which were removed surgically, exclusive of those involving the mediastinum. The authors have encountered four similar tumors. Of other tumors of the chest wall, neurogenic tumors comprise about one third of the total number, with neurogenic sarcomas outnumbering the benign by 10 1.

Basically, there are two distinct histologic forms of benign neurogenic tumor, the commonest being neurofibroma It is gray, firm and nonencapsulated. Histologically, it consists of elongated Schwann cells interspersed between haphazardly arranged connective tissue cells It is characteristically found in Recklinghausen's disease but may be found unassociated with generalized neurofibromatosis. The second type is the neurilemmoma. These tumors are usually well

(1) Am. Surg. 138 104 110 July 1953

encapsulated and yellowish and often contain areas of ne crosis and degeneration Histologically, they are solid and present an interlacing syncytium of Schwann cells with prominent palisading of the cell nuclei. The neurilemmoma is probably always benign and does not recur after com plete surgical removal, whereas recurrence is not uncom



Fig. 49 —Large circumscribed mass in lower lateral part of right hemithorax, ex tending from above 7th rib to below 10th rib posteriorly (Courtesy of Hochberg, L. A. and Rivkin L. M.: Ann. Surg. 138:104 110 July 1953)

mon after surgical excision of the neurofibroma and malig nant transformation is quite common

The patient with benign neurogenic tumor of the chest wall usually complains of pains at the site of the tumor and radiation of pain along the course of distribution of the in volved nerve When the growth is massive, symptoms may be produced by compression and impairment of function of neighboring tissues or both. There may be erosion of the adjacent rib Chest x rays are fairly characteristic A cir cumscribed dense area is found within the chest wall (Fig 49)

Therapy is unquestionably surgical excision. The procedure is not formidable and is indicated not only to relieve the symptoms but to remove a tumor that is potentially or already malignant. A distinct differentiation cannot be made until representative tissue is examined under the microscope

[This article gives the impression that these tumors are more rare than they probably actually are. Doubtless many of them are not reported. A spherical x ray shadow seen in the posterior mediastinum or connected with the posterior chest wall is more likely to represent a neurogenic tumor than anything else.—Ed.]

Tracheal Diverticula. Donald MacKinnon[2] (St. James's Hosp., Leeds) reports 10 cases of tracheal diverticula, 8 found in 867 routine autopsies and 2 from a pathology museum The diverticula were ovoid pedunculated or sessile cysts with the long axis vertical, measuring 0.5-3 cm. in longest diameter All were attached to the right postero-lateral border of the trachea and, with one exception, the upper border lay just below the lower pole of the thyroid gland In the lumen of the trachea at the junction of the cartilage rings and trachealis muscle, an opening of pinhead size was seen opposite the midpoint of each cyst. When pressure was applied to the cysts, mucopurulent fluid was expressed into the trachea through these openings. Several smaller openings were present in a vertical line above and below the main opening Histologically the diverticula were either uni or multilocular and lined by stratified columnar ciliated epithelium with chronic inflammation. A duct lined by ciliated columnar epithelium connected the cysts to the trachea in some cases In sections of the tracheal wall through the smaller openings, unrelated to any cyst were dilated ducts of mucous glands These ducts were assumed to be the earliest stage in formation of the cysts

All the patients had chronic respiratory disease and cough It seems likely that chronic tracheitis led to hyperplasia of the tracheal mucous glands and consequent enlargement of the ducts draining these glands. Further dilatation resulted from raised intratracheal pressure caused by repeated bouts of coughing. With one exception, the cysts occurred on the right side of the trachea because that side is unsupported whereas the left side is supported by the esophagus

(2) J Path. & Bact. 65 513 51- April 1953

Costoclavicular Compression of Subclavian Vein R. Wyburn Mason[3] (Royal Cancer Hosp) presents two cases in which traumatic wrenching of the shoulder appears to have led to costoclavicular compression or pressure by the first rib producing its chief effect on the subclavian vein rather than on other structures

Man, 29, caught his right hand in a conveyor belt, with violent abduction and pulling down of the limb There was a tearing sensation followed by aching Within an hour the hand and arm began to swell, the hand became numb and cold and movement of the hand and fingers was lost. Edema did not subside, and two weeks later he had sudden fever of 100.8 F., rigors, chest pain, sweating, rapid respiration and right axillary tenderness. These symptoms subsided after two weeks' treatment with sulfathiazole and penicillin. At four months the arm was unchanged, with pitting edema of the entire upper limb There was marked dropping of the tip of the right shoulder (about 3 in.) The right radial pulse was weaker than the left. With shoulders drawn back, blood pressure on the right was 110/40 mm., on the left 130/80 mm. Pinprick was not appreciated over the inner arm, forearm and hand. Edema subsided if the right arm was raised above the head. Diagnosis was costoclavicular compression of the subclavian vein. One year after injury, exploration revealed compression of the subclavian vein by the first rib without thrombosis. The omohyoid and scalenus anterior muscles were divided and 1½ in. of the first rib underlying the brachial plexus and subclavian vein removed. All edema disappeared by the day after operation and recovery was uneventful

When the tip of the shoulder drops from damage to structures supporting it, the subclavian vein may be compressed as it passes over the first rib which may cause venous edema. The second case was similar to the first.

Edema of the arm following radical mastectomy may be accompanied by recurrence of the growth, lymphangitis or cellulitis or may occur following normal use with no premonitory signs or symptoms Whereas lymphatic edema is of a persistent, brawny type, venous obstruction leads to a soft pitting type usually due to spread of the malignancy to the axillary and subclavian vessels. If venous edema is not relieved promptly there is increasing lymphatic obstruction and mergence into the lymphaticovenous type

Of 32 cases of postoperative edema of the arm after radical mastectomy, usually followed by irradiation, marked

(3) Brit. M. J 2 1198 1200 Nov 28 1953

dropping of the tip of the shoulder of the affected side was noted in 4. In all four, edema appeared early and before irradiation. Venous pressures in the affected arms were elevated. Edema could be relieved by elevation of the tip of the shoulder by a sling raising the elbow In some cases edema might be relieved by removal of that portion of the first rib causing obstruction of the subclavian vein Contrary to common belief, the shoulder girdle may, in part, be held in position not only by structures above but also by support below on the structures of the axilla which are removed during radical mastectomy

Use and Abuse of Chest Drainage According to Benson B Roe[4] (Univ of California), drainage of the pleural cavity is directed at evacuation of accumulations of blood or serum that may act as a nidus of infection and at preservation of pulmonary expansion.

Pneumonectomy is the single exception to the rule of routine drainage, the risk of bronchial air leak is superseded by the importance of avoiding mediastinal flutter by maintenance of a constant volume, airtight space Transthoracic procedures in the mediastinum or abdomen, with no possibility of air leak, require drainage only for evacuation of fluid. Lobectomy and segmental resection may have significant air leak, thus it is essential to prevent tension pneumothorax and maintain sufficient vacuum to remedy atelectasis in lobes compressed at operation. The tube should be placed in the region of the resected lung so air can escape freely Fluid can be removed by turning the patient or by placing a second tube in a dependent position. Excessive suction before air leakage has stopped may produce a persistent bronchopleural fistula.

In spontaneous and traumatic pneumothorax, air leaks are usually small and will close when partial lung collapse occurs Aspiration should therefore be delayed unless pneumothorax is progressive Here catheter drainage with suction is worth a trial if adequate expansion is not accomplished with an indwelling needle In hemothorax, prompt and thorough evacuation of blood is important to avoid the possibility of empyema and fibrothorax requiring decortica

(4) West. J Surg. 61:706 710 December 1953.

tion. Needle aspiration, catheter drainage or thoracotomy should be used as necessary

Early rib resection and open drainage for empyema have given way to repeated needle aspiration of the pus and instillation of antibiotics and enzymes, with open drainage still recommended for unresponsive, fulminating septic em



Fig. 50 —Chest drainage tubes. *A* mushroom catheter *B* Robinson catheter *C*, Foley catheter Note how the protruding Foley catheter tip prevents apposition of the lung which may occur with other tubes. (Courtesy of Roe B. B. West. J. Surg. 61:706-710 December 1953)

pyema. Closed tube drainage with powerful suction (—100 to —200 cm. H_2O) may obliterate some cavities

Liquefaction of clot, fibrin and necrotic exudate with chemical agents is a valuable aid in evacuation of the pleural space, particularly through a needle Enzymatic agents include the fibrinolytic bacterial products streptokinase and streptodornase and the pancreatic proteolytic enzyme trypsin Patency of tubes may be maintained by irrigation and injection of clot liquefying enzymes When lung expansion against the tube is inevitable a protruding large lumen Foley catheter with a small bag may be useful (Fig 50)

Scalene Node Biopsy in Diagnosis of Diseases of Chest Clinton A. Piper[5] (Brooke Army Hosp), using scalene node biopsies, obtained 52 definitive diagnoses in 185 cases of chest disease The technic is similar to that for approaching the phrenic nerve The right side is used to avoid the thoracic duct, unless the major pathologic process is in the left hemithorax. Local anesthesia is employed and a transverse incision made above the clavicle extending backward from the sternocleidomastoid muscle The carotid sheath, phrenic nerve and transverse cervical vessels are retracted The node-containing fat anterior and medial to the caudal portion of the anterior scalene muscle is excised and the nodes dissected. Half of each node is submitted for histologic study and half for cultures for fungi and tuberculous organisms There have been no major complications

This procedure is indicated in any undiagnosed intrathoracic disease Idiopathic pulmonary fibrosis, hilar enlargement, mediastinal and parenchymal masses, and persistent or shifting infiltrations represent the commonest problems The procedure is especially useful in Boeck's sarcoid and bronchogenic carcinoma.

Benign Cystic Thymoma. Charles C Pixley, Clinton A. Piper and Warner F Bowers[6] (Brooke Army Hosp) report a case

Man, 28, was hospitalized because of a large anterior mediastinal mass noted on routine chest x ray He was asymptomatic except for slight shortness of breath on exercise and occasional substernal burning on lifting or straining during the preceding month. Decreased breath sounds and dulness to percussion were noted parasternally Results of laboratory studies were negative. All x ray studies confirmed the presence of a large, oval anterior mediastinal shadow There was no evidence of pulsation or connection of the mass with vessels, esophagus or mediastinum. Exploratory thoracotomy through the bed of the right fourth rib anteriorly revealed a large thin walled cyst in which there was an estimated 1,000 cc of yellow brown opalescent fluid containing fine cholesterol crystals. The cyst was removed intact. A small pedicle at the cephalad aspect contained three moderate-sized vessels. Water seal drainage was employed for 24 hours. The postoperative course was uneventful. Microscopic examination revealed small amounts of lymphoid tissue containing typical Hassall corpuscles. Sections of the cyst revealed a thin layer

(5) Am. Pract. & Digest Treat. 5:18 183 March, 19 4
(6) J Thoracic Surg. 27 3 3 377 April, 1954

of small, round, blue cells, apparently lymphocytes, as the lining Pathologic diagnosis was mediastinal cyst—thymoma.

A report of only one other similar benign thymic tumor was found in the literature

Funnel Chest Indications for Surgery and Time of Choice for Operation. Because of the widespread uncertainty as to the fate of patients with funnel chest in later life and as to the indications for operation, Alexander H. Bill, Jr[7] (Univ of Washington) sent a questionnaire relating to these problems to a group of American surgeons and physicians with wide experience in diseases of the chest. Twenty five questionnaires were answered completely enough to be useful and the answers tabulated as follows

1 What proportion of adults with severe funnel chest deformity develop

a) Cardiac disability

"Some"	13	Yes 16
100%	2	
75%	1	
None	7	No 7
No opinion	2	

b) Pulmonary disability

"Some"	8	Yes 13
100%	2	
"Majority"	3	
None	8	No 8
No opinion	4	

c) Psychologic disability

"Majority"	7	Yes 14
100%	4	
"Some"	3	
None	5	No 5
No opinion	6	

2. Will presence of severe funnel chest shorten life span?

		Yes 9
		No 10
No opinion	6	

3. Should a severe grade of funnel chest be repaired in childhood?

		Yes 23
		No 0
No opinion	2	

(7) Pediatrics 11 582 587 June 1953

The author operated on eight patients, the procedure on two consisting simply in freeing the inner surface of the sternum from its posterior attachments Little improvement was noted in these two The other six underwent a more radical procedure, removal of the backward projecting segments of the lower costal cartilages with a wedge osteotomy across the upper sternum to permit it to come forward Three showed excellent results after a year, operation on two was too recent for evaluation of results, and in the sixth patient, a boy, 15, correction of the deformity was incomplete

As the patient grows older the operation becomes progressively more trying for him and more difficult for the surgeon. It is felt that when indicated it is best carried out between ages 2 and 6

[For psychologic reasons alone a funnel chest, when the deformity is bad, should be corrected in childhood to avoid the jibes received in swimming and in the locker room.—Ed.]

Bronchogenic Cysts of the Mediastinum are usually related to developmental defects in the bronchial tree or to the presence of aberrant pulmonary tissue They often remain undetectable for long periods except by radiologic examination. Any clinical symptoms are directly proportional to the size and location of the cysts and especially to the presence of infection, according to Mario M. Brea and Vicente N Roger's Accumulation of secretions in the cysts leads to their enlargement, and the consequent irritation, displacement or compression of adjacent structures (nerves blood vessels or air passages) may produce cough, pain and dyspnea of varying intensity Suppuration resulting from infection often clouds the diagnosis and complicates treatment

Surgical removal of all benign mediastinal tumors for diagnostic and curative purposes is advocated Surgical exploration is necessary for accurate evaluation of the nature of the tumors and forecast of their future development Since cystectomy remedies the condition, obviates complications that otherwise invariably darken the prognosis and has a wide margin of safety, it should be performed without hesitation unless formally contraindicated. The authors used

(8) Acad. argent. cir., Bol. y trab 37:11 122 1952.

it successfully for six patients, 18 57, all of whom recovered without sequelae

[These cysts are likely to be confused with reduplications of the alimentary tract, as, for example, thoracic stomachs. The exact diagnosis, however is not important, since in either case the abnormality should be removed.—Ed.]

Fatal Hemorrhage Resulting from Incoagulability of Blood during Thoracic Surgery Eudorico da Rocha Junior, Isaac Malogolovkin and Eduardo Marques Tinoco[9] (Rio de Janeiro) attribute the deaths of two patients undergoing endothoracic operations (esophagectomy for esophageal cancer and pneumonectomy for chronic empyema) to a syndrome of afibrinogenemia due to fibrinolysis Afibrinogenemia has lately become prominent because of the fatal hemorrhagic complications attributable to it in endothoracic surgery and similar though not necessarily fatal complications attributable to it in other clinical and obstetric eventualities

Fibrinolysis may result from an increase in the activating component (fibrinokinase), from inactivity of the factor inhibiting lysis (antifibrinokinase) or from both together The lung, like the uterus and the prostate gland, is known to be especially rich in these substances it is, therefore not surprising that the handling of the lung in thoracic surgery should result in the liberation of fibrinokinase to the critical level at which incoagulability appears Laboratory tests demonstrated a complete absence of fibrinogen in the blood of the authors' patients The two mechanisms to which complete absence of fibrinogen has been attributed are complete consumption of the fibrinogen by microscopic intravascular coagulation and the fibrinogenolysis produced by enzymatic action The authors believe that both mechanisms participate in the process with lysis following intravascular coagulation. The hemorrhagic syndrome appears whenever the factors tending toward hypercoagulability are overbalanced by those producing fibrinolysis. The consequent complete lysis of all the fibrinogen either in the patient's blood or in that used for transfusion thereby represents a disturbance in the antihypercoagulability defense mechanism. Of various methods of treatment suggested, none

(9) Rev brasil. cir 24 819 834 December 1952.

is effective Blood transfusions, though indispensable during thoracic surgery, intensify the lysis by supplying the body with fresh quantities of profibrinolysin.

Management of Wounds of Chest and Abdomen Associated with Penetrating Brain Wounds Frank B Berry[1] (Columbia Univ) states that the three objectives of treating multiple wounds are to save the life, conserve tissue and restore function The most important immediate emergencies are to stop hemorrhage and to provide adequate oxygenation and proper airway The patient should be examined thoroughly and quickly for brain, chest, intra abdominal, bladder and extremity injuries Chest injuries should be treated first and efforts directed to restoring the cardiorespiratory system to normal physiologic balance, allaying pain and maintaining a free and easy respiration Tracheostomy may be required Sucking wounds of the chest should be sealed, and any tension pneumothorax should be aspirated Resuscitation measures include warming and administration of plasma or plasma extenders and whole blood. If there is no response to these measures in two hours, it is wise to proceed with surgery The great danger in abdominal trauma is infection An abdominal injury can be repaired at the same time as the chest injury, either through a separate incision or through the diaphragm Antibiotics must be used in abdominal infection

Surgery to correct brain injury can be safely postponed for 24-36 hours in order to correct the chest and abdominal lesions if there is no increasing intracranial pressure The patient's age and any pre-existing disease must be considered in cases of trauma

Derangements of body metabolism such as sodium and potassium imbalance, must be recognized and treated in injured patients.

(1) Mil. Surgeon 113 445 4-7 December 1953

it successfully for six patients, 18-57, all of whom recovered without sequelae

[These cysts are likely to be confused with reduplications of the alimentary tract, as, for example, thoracic stomachs. The exact diagnosis, however is not important since in either case the abnormality should be removed.—Ed.]

Fatal Hemorrhage Resulting from Incoagulability of Blood during Thoracic Surgery Eudorico da Rocha Junior, Isaac Malogolovkin and Eduardo Marques Tinoco[9] (Rio de Janeiro) attribute the deaths of two patients undergoing endothoracic operations (esophagectomy for esophageal cancer and pneumonectomy for chronic empyema) to a syndrome of afibrinogenemia due to fibrinolysis Afibrinogenemia has lately become prominent because of the fatal hemorrhagic complications attributable to it in endothoracic surgery and similar though not necessarily fatal complications attributable to it in other clinical and obstetric eventualities

Fibrinolysis may result from an increase in the activating component (fibrinokinase) from inactivity of the factor inhibiting lysis (antifibrinokinase) or from both together The lung, like the uterus and the prostate gland, is known to be especially rich in these substances, it is, therefore, not surprising that the handling of the lung in thoracic surgery should result in the liberation of fibrinokinase to the critical level at which incoagulability appears Laboratory tests demonstrated a complete absence of fibrinogen in the blood of the authors' patients The two mechanisms to which complete absence of fibrinogen has been attributed are complete consumption of the fibrinogen by microscopic intravascular coagulation and the fibrinogenolysis produced by enzymatic action. The authors believe that both mechanisms participate in the process with lysis following intravascular coagulation. The hemorrhagic syndrome appears whenever the factors tending toward hypercoagulability are overbalanced by those producing fibrinolysis. The consequent complete lysis of all the fibrinogen either in the patient's blood or in that used for transfusion thereby represents a disturbance in the antihypercoagulability defense mechanism Of various methods of treatment suggested, none

(9) Rev brasil. cir 24 819 834 December 1952.

is effective Blood transfusions, though indispensable during thoracic surgery, intensify the lysis by supplying the body with fresh quantities of profibrinolysin.

Management of Wounds of Chest and Abdomen Associated with Penetrating Brain Wounds Frank B Berry[1] (Columbia Univ) states that the three objectives of treating multiple wounds are to save the life, conserve tissue and restore function. The most important immediate emergencies are to stop hemorrhage and to provide adequate oxygenation and proper airway The patient should be examined thoroughly and quickly for brain, chest, intra abdominal, bladder and extremity injuries Chest injuries should be treated first and efforts directed to restoring the cardiorespiratory system to normal physiologic balance, allaying pain and maintaining a free and easy respiration. Tracheostomy may be required Sucking wounds of the chest should be sealed, and any tension pneumothorax should be aspirated. Resuscitation measures include warming and administration of plasma or plasma extenders and whole blood. If there is no response to these measures in two hours, it is wise to proceed with surgery The great danger in abdominal trauma is infection An abdominal injury can be repaired at the same time as the chest injury, either through a separate incision or through the diaphragm. Antibiotics must be used in abdominal infection.

Surgery to correct brain injury can be safely postponed for 24-36 hours in order to correct the chest and abdominal lesions if there is no increasing intracranial pressure The patient's age and any pre-existing disease must be considered in cases of trauma

Derangements of body metabolism, such as sodium and potassium imbalance, must be recognized and treated in injured patients

---

(1) Mil. Surgeon 111 443 [illegible] December 1952

Surgical Treatment of Tuberculous Pericarditis Reeve H. Betts and J Thompson Wells[2] (Vellore, South India) attribute many cases of constrictive pericarditis to tuberculous infection and feel that it is possible not to recognize tuberculosis in many patients operated on after the subsidence of the acute process *Rheumatic infection is rarely a cause* of pericarditis, infection by either pyogenic organisms or tubercle bacilli is more common Any patient who has had demonstrable pericardial effusion, whether purulent or tuberculous, or any patient who has had blood in the pericardium may eventually have the syndrome of polyserositis due to impediment of the venous return.

The clinical features of constrictive pericarditis include increased venous pressure, peripheral edema usually associated with ascites and often with pleural effusion, normal or low blood pressure, decreased pulse pressure, paradoxical pulse, fluoroscopic and roentgen evidence of a quiet heart that does not beat vigorously and, in long standing cases, calcium plaques on the pericardium If a history of earlier febrile illness is given or if there is an active tuberculous process in the lungs, diagnosis of constrictive pericarditis *due to tuberculosis may be established quickly* The ECG tracing usually exhibits low voltage of the QRS complexes and inversion of the T waves There usually is no orthopnea.

Tuberculous pericarditis generally requires surgical treatment Preoperative preparation is directed toward getting the patient into the best possible state for operation If there is any evidence of an active tuberculous focus either in the pericardium or elsewhere, treatment with streptomycin and PAS is indicated. All accumulations of fluid in the various serous cavities should be removed by repeated aspiration There are often pronounced diminution in the serum protein level and reversal of the albumin globulin ratio which should be corrected General anesthesia with an endotracheal

(2) Indian J Surg 15 1 14 March, 1953

tube in place is preferable In most cases, encasement of the left ventricle is the most prominent feature and its complete freeing is necessary for a good surgical result However, in other cases the right side of the heart seems to be involved as much if not more than the left and it is believed that complete freeing of the heart should always be carried out. Holman's splitting incision of the lower sternum has been found to provide adequate exposure for pericardiectomy Whenever resection of the pericardium has been satisfactory clinical response has usually been rapid and complete If improvement is slow and extends for many months, incomplete freeing of the heart is probably the reason

In three of four pericardiectomies described, the lesions were definitely tuberculous and in each case there was striking dramatic improvement immediately after operation, although one patient subsequently returned with active pulmonary tuberculosis The fourth patient had extensive pulmonary tuberculosis but no evidence of active tuberculous foci in the excised pericardium although it was thought that this lesion had undoubtedly been tuberculous at the time of its origin In this patient complete decortication was not done and he was the only one of the four who merely improved, instead of being apparently cured, a second operation may eventually be necessary

[Complete decortication is desirable but sometimes it cannot be performed satisfactorily because of danger of severe damage of the heart muscle. Occasionally cases are encountered in which projections of calcified scar tissue pass from the pericardium into the myocardium to such an extent that a separation of the pericardium cannot be accomplished without extensive laceration of the myocardium.—Ed.]

Problems of Surgical Therapy in Angina Pectoris are discussed by W Weissel, M Wenzl and G Wense[3] (Univ of Vienna) The following methods have been tried for relief of anginal pain (1) neurosurgical procedures, (2) thyroidectomy, and (3) improvement of vascularization of the heart muscle

Of the neurosurgical procedures fair results were achieved with procaine infiltration of the sympathetic nerve and the stellate ganglion Extirpation of the stellate ganglions and cervicothoracic sympathectomy were performed with good

(3) Wien. klin. Wchnschr 65:831-835 Sept. 5 1953

results when procaine infiltration gave only brief relief

Total thyroidectomy is being replaced by use of radioactive iodine (I^{131})

Neurosurgery and thyroidectomy should be tried before more complicated technics of improving coronary circulation directly are considered The authors investigated in dog hearts Vineberg's method of implanting the internal mammary artery into the myocardium Vascular visualization as well as histopathologic studies revealed development of a functioning collateral circulation between the mammary and coronary arteries The authors feel that the good experimental results warrant a trial on the human heart They also prefer this method over other, more difficult cardiac surgery

Valvulotomy for Mitral Stenosis E Husfeldt, H. C Engell and Asger Pedersen[4] (Rigshosp, Copenhagen) operated on 60 patients for mitral stenosis caused by rheumatic fever in 25 cases, by recurrent tonsillitis in 9, by chorea minor in 6, by scarlet fever with arthritis in 4 and by myocarditis with mitral incompetence and congenital deformity in 1 each and by unknown mechanisms in 14. Of the 60 patients, 9 died According to the American Heart Association's classification for the estimation of heart failure, preoperatively 13 patients were in group II, 34 in group III and 13 in group IV All of the deaths were in groups III and IV Of 45 patients aged 14-40 2 died and of 15 patients aged 41 54, 7 died The operative mortality was not high in the patients who complained only of slight dyspnea and slight cardiac enlargement or those with hemoptysis and pulmonary edema. It was, however, high (about 40%) in patients with auricular fibrillation, peripheral emboli, right sided heart failure severe enlargement of the heart, engorgement of the liver, ascites and hydrothorax. Catheterization of the heart was performed before operation on 56 patients, half of whom had a systolic pressure in the pulmonary artery above 60 mm Hg at rest (normal below 30 mm.) and a mean pulmonary capillary pressure above 30 mm Hg (normal below 15 mm) Most severe cases fell in this group

(4) Acta chir scandinav 103 144 160 1952

Owing to the questionable reliability of the diagnostic criteria, patients who were supposed to have some degree of mitral incompetence were operated on Surgery disclosed pure stenosis in 37 patients, 16 had considerable incompetence and 7 had pure incompetence It was proved to be possible to diagnose most cases of mitral incompetence by stethoscopic examination Pulmonary capillary pressure curves were also accurate in the prediction of the presence of incompetence

Valvulotomy was performed by means of the finger alone except in four cases in which an instrument was used. The finger, unprotected by a glove is preferred because it affords a far better impression of the anatomic details and the amount of regurgitation. Among 33 postoperative complications, 2 involved a tear in the left atrium, 18 transitory auricular fibrillation, 7 pulmonary infarct, 5 cerebral emboli and 2 a faulty diagnosis. Of 36 patients re-examined 4-22 months after operation, 24 could be placed in a better category of the American Heart Association classification Patients who failed to improve were chiefly those who had predominant mitral incompetence and those with leathery elastic valves

Repeated attacks of pulmonary edema and hemoptysis were absolute indications for operation. Earlier peripheral emboli, combined stenosis and incompetence, and right sided heart failure are only relative contraindications in patients under 40 In patients past 40, the indications must be narrowed Contraindications include active rheumatic infection, complicated aortic failures of clinical importance and pronounced incompetence indicated by stethoscopic findings and pulmonary capillary pressure curves

Postoperative Syndrome Following Mitral Valvuloplasty, found in 7 of 75 patients is described by Bernard A. Bercu[5] (Washington Univ) Symptoms began about three to four weeks after operation with onset of general malaise Four patients had fever, and two arthritis and hot, swollen joints all had tachycardia, and four had a pronounced increase in symptoms of congestive failure All were treated with bed rest and salicylates in addition to their previous

(5) J Lab. & Clin. Med. 4[illegible] 83 November 1953

medication, and symptoms gradually disappeared in 4-12 weeks without sequelae

This symptom complex strongly suggests the occurrence of rheumatic activity, but this is unproved. The fact that all patients were treated with penicillin from the day of operation to onset of symptoms makes the presence of unsuspected beta hemolytic streptococcus infection unlikely No evidence of rheumatic activity was present at the time of operation It is conceivable that trauma to the heart might in some way be related to onset of the syndrome The patients subsequently did as well as those without complications but required more time to reach a comparable state of improvement

[One wonders how often these symptoms occur It is hoped that other series of patients will be examined and reported with reference to this syndrome.—Ed.]

Peripheral Embolization Following Mitral Commissurotomy Frank Tropea, Jr, and Joseph Entine[8] (Hahnemann Med College, Philadelphia) note that mitral commissurotomy for stenosis, with its attendant intracardiac manipulation, has introduced another major cause of arterial embolization. They report the 42d successful aortic bifurcation embolectomy following mitral commissurotomy for stenosis.

Man, 27, with progressive exertional dyspnea since 1947, in 1948 developed frank cardiac decompensation which responded to digitoxin and mercurials. In 1949 he had persistent auricular fibrillation. Embolization to the left popliteal artery, which responded to conservative treatment, occurred in 1949, and a splenic infarct was diagnosed in 1951. Persistent hemoptysis developed in 1951. A grade 2 to 3 high pitched musical systolic mitral murmur was heard in the axilla and back. A grade 3 mitral diastolic rumble accompanied by a thrill was also present. Liver and spleen were just palpable.

On Jan. 9, 1952, mitral commissurotomy was performed on a markedly stenosed and calcified mitral valve. The left auricular appendage seemed to be full of soft thrombi. To reduce the possibility of embolization an O'Neill clamp was placed across the base of the appendage and all visible clots evacuated, and the operation was performed without incident. The patient complained of severe pain and numbness of the legs and feet 2½ hours later The femoral popliteal and dorsalis pedis pulses were absent bilaterally Diagnosis was saddle embolus of the aorta, and continuous caudal anesthesia was started. The aorta was approached 5½ hours after the commissurotomy through a left tr srectus incision Longitudinal in

(8) A.M.A. Arch. Surg 67: 83

cisions were made in both common iliac arteries and clots were milked and sucked out. After the abdomen was closed, strong femoral pulses were present bilaterally. The caudal anesthesia was continued for 72 hours postoperatively, during which time the feet became progressively warmer and less painful, and both dorsalis pedis pulses were restored. Heparin was given intermittently for 72 hours postoperatively to keep the venous coagulation time between 15 and 20 minutes. At follow-up 11 months later the patient was without leg or cardiac symptoms and was employed full time.

If treatment of postoperative emboli is to be successful, an awareness of them must be kept in mind and their occurrence detected immediately. All pulses should be checked and recorded preoperatively and again immediately postoperatively. If an embolus is suspected, immediate continuous sympathetic block to the involved area is instituted. If improvement is not noted in one hour, the embolus is removed surgically, followed by sympathetic block for three to five days. Only through early diagnosis and rapid institution of adequate treatment can lives and limbs be saved.

Aortic Commissurotomy is discussed by Henry Byron Larzelere and Charles Philamore Bailey[7] (Hahnemann Med. College). Although the prime concern is with the adult ac-

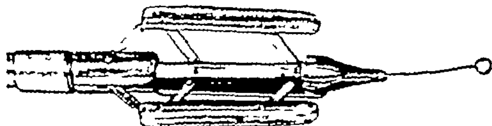


Fig. 51.—Expanding blades and guide wire of dilator designed, engineered and manufactured by Major John Shearman Donaldson, Chatham, N. J. (Courtesy of Larzelere, H. B., and Bailey, C. P.: J. Thoracic Surg. 26:31-66, July, 1953.)

quired rheumatic type of aortic stenosis, there is sufficient experience to warrant concern over the differentiation of the several types of aortic stenosis, including the degenerative and congenital types. There is a high incidence of simultaneous involvement of the mitral valve.

It has been observed that the fused aortic commissures in rheumatic aortic stenosis tend to separate anatomically

(7) J. Thoracic Surg. 26:31-66, July, 1953.

with the application of any blunt dilating force within the valve orifice To implement this principle, a mechanism with three parallel dilating bars on a swivel mechanism, which could automatically adjust to the remnants of the fused

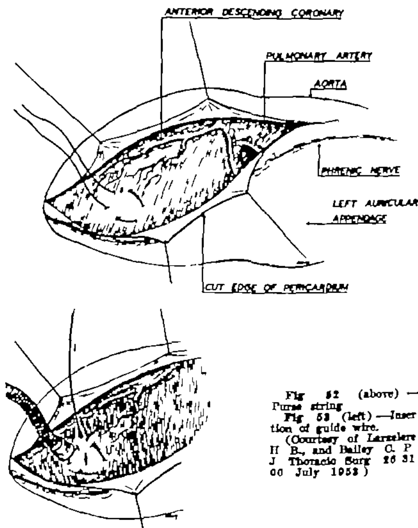


Fig 52 (above) — Purse string
Fig 53 (left) — Insertion of guide wire.
(Courtesy of Larzelere H B., and Bailey C. P J Thoracic Surg 26 31 00 July 1953)

commissures, was developed and perfected in March 1952 by Maj John Shearman Donaldson of Chatham, N J A beaded guide wire was incorporated in the instrument (Fig 51)

The cusps resulting from the division of the truncus arteriosus into the two major vessels are so placed that the anterior commissure of the aortic valve is immediately ad

jacent to, and in line with, the center point or axis of the two valve rings. Lining up of the pulmonary and aortic valve rings allows the commissures to be envisioned accurately When the handle is placed in line with the rings, one of the expanding blades is in line with the anterior aortic commissure and the other two will be accurately applied to the two posterolateral commissures Because of the 360 degree swivel mechanism at the neck of the instrument, the head, at initial engagement into the valve orifice automati

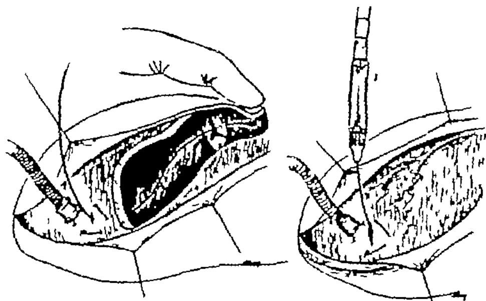


Fig 54 (left) —Passage of guide wire through aortic orifice.
Fig 55 (right).—Enlargement of ventricular incision to receive head of instrument. (Courtesy of Larzelere H. B. and Bailey C. P J Thoracic Surg 26:31-66 July 1953.)

cally tends to become correctly alined to any remnants of the diseased commissures

From the standpoint of technic and for the best operative performance, the lateral position is the choice Because of the high incidence of coexistent mitral disease, which may be overlooked in the preoperative evaluation of the patient, the mitral valve should be explored digitally at the time of the aortic commissurotomy As patients tend to do badly when one valve is left uncorrected, simultaneous attack on both aortic and mitral stenosis is recommended for combined valvular lesions It is preferable to do the mitral commissurotomy first, especially if both valves are stenosed

Although refusion of the commissures is possible, no known case of such refusion has been reported

TECHNIC.—Light endotracheal anesthesia is preferred, with full

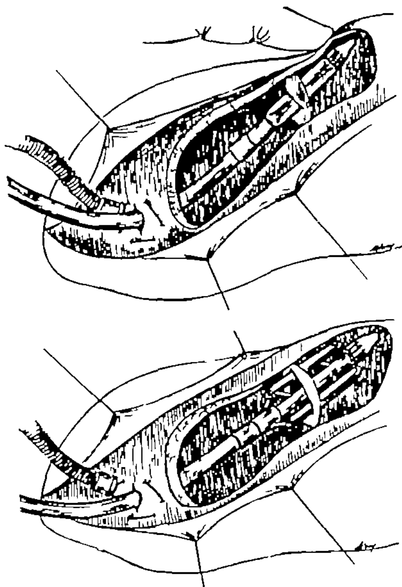


Fig 56 (top) —Engagement at aortic valve.
Fig 57 (bottom) —Effecting aortic commissurotomy
(Courtesy of Larzelere, H. B., and Bailey C. P: J Thoracic Surg 26:31-66 July 1953)

preparation for surgery before anesthesia so that cardiac recovery may be effected immediately in case of arrest or ventricular fibrillation. The chest is opened through the left fifth interspace. The superior mediastinum is entered just above the aortic arch, and the left common carotid artery and the innominate artery are dissected

free and encircled by narrow umbilical tapes run through and fixed to a Rumel Belmont tourniquet. These tapes now control and permit interruption of blood flow to the brain to prevent cerebral emboliza tion during operative or manipulative procedures either on or in the heart. The pericardium is opened to expose the posterolateral surface of the left ventricle and the first portion of the aorta. The dilator is set so that the blades expand to within 1 or 2 mm. of the external aortic ring diameter

After thorough injection of the area with 1% procaine, a tripoint purse-string suture is placed in a relatively avascular area on the anterolateral aspect of the left ventricle. Delicate, yet adequate con trol of this suture is effected by use of the Rumel Belmont tourni quet (Figs. 52 and 53) A tiny longitudinal stab wound is made through the ventricle at the center of the purse string. The guide wire is inserted and passed up and through the orifice of the aortic valve (Figs 53 and 54) The guide may be palpated through the first portion of the aorta. The incision is enlarged (Fig 55) and the dilator head passed to engage within the orifice of the aortic valve (Fig 56) The head is alined, and when it is properly en gaged the blades are extended (Fig 57) The blades are extended two or three times and the instrument removed. The wound in the heart is closed with interrupted or small mattress sutures. The peri cardium is allowed to drain through loose approximation into the pleural space. Should there be a tendency for pericardial fluid to form postoperatively, pericardiocentesis may be necessary

The indication for aortic commissurotomy is presence of clinically significant aortic stenosis. Contraindications in clude persistent congestive failure despite diligent medical treatment, a large "worn out" left ventricle, gallop rhythm, advanced myocardial insufficiency, active rheumatic fever, subacute bacterial endocarditis and age beyond 50

There were 7 deaths in 42 cases of aortic stenosis with and without other valvular disease In 13 cases of isolated aortic stenosis there was 1 death. Of the patients with iso lated aortic valve, 77% were improved. Among those with multiple valves, 72 4% were improved

Problems in Diagnosis and Surgical Treatment of Pul monic Stenosis with Intact Ventricular Septum. John W Kirklin, Daniel C Connolly, F Henry Ellis, Jr., Howard B Burchell, Jesse E Edwards and Earl H Woods[8] (Mayo Clin ic) state that obstruction to pulmonary blood flow may oc cur in the pulmonic valve, in the infundibulum or outflow tract of the right ventricle, or in both Cardiac catheteriza

(8) Circulation 8 849 863 December 1953

tion aids in determination of the site of obstruction. Pulmonic stenosis can be diagnosed at cardiac catheterization by demonstration of high systolic pressure in the right ventricle and low systolic pressure in the pulmonary artery Roentgenoscopic observation of the catheter tip, with continuous monitoring of the pressure being transmitted through the catheter, aids in localizing the region in the cardiac shadow at which the change occurs In ideal circumstances it is possible to determine whether this change takes place abruptly in the region of the pulmonic valve or whether it is first detected at a position in the outflow tract of the ventricle Isolated valvular stenosis will cause an abrupt change in systolic pressure, whereas infundibular stenosis will cause an intermediate zone of pressure between the high pressure of the ventricle and the low pressure of the pulmonary artery

The site of obstruction must be carefully identified at surgery The presence and location of a thrill and a palpable, stiff pulmonic valve establish the diagnosis of pulmonary stenosis Pressure recordings during the operation will identify any infundibular obstruction Surgery must adequately treat both types of obstruction if they are present together A correctly selected operation must be carried out in as complete a manner as possible, and pressure determinations during the operation will aid in determining the extent of surgery

Of 12 patients operated on for pulmonic stenosis, 6 had combined valvular and infundibular stenosis, 4 valvular stenosis alone and 2 infundibular stenosis alone There were two operative deaths All 10 survivors were much improved subjectively Postoperative cardiac catheterizations were carried out to determine objective improvement. Best results were found in patients with valvular stenosis as an isolated lesion There was no dramatic diminution of the right ventricular pressure postoperatively in the two patients with infundibular stenosis as an isolated lesion, but there was a moderate fall. Further follow up is necessary to determine the long term results as measured by permanent decreased right ventricular pressure

Cardiac Surgery under Hypothermia. Charles P Bailey, Brian A. Cookson, Daniel F Downing and Wilford B Neptune[9] (Hahnemann Med. College) believe that for cardiac surgery the proper state of hypothermia is between 74 and 80 F (23 3 and 26 6 C) The value of hypothermia lies in depression of (1) tissue demand for oxygen, which varies directly with degree of cooling, and (2) the diminution of myocardial activity, with reduction in its demand for oxygen The infant heart is better able to tolerate and recover from low temperatures than the adult heart.

The use of arterial transfusions of red cells suspended in gelatin Ringer solution to maintain high pressure in the aortic arch reduces significantly the high incidence of air embolism when the left side of the heart is opened and prolongs the period during which circulation may be clamped off This raises the safe time for clamping the vena cava in dogs at 76 F (24 4 C) from 12 to 20 minutes

Several technics of closed cardiac surgery might be improved if they could be performed under direct vision The over all mortality of 69.2% in the 12 cases reported is attributed to the severity of the lesions (five congenital transpositions) and condition of the patients Treatment of transposition by division and re anastomosis of the transposed aorta and pulmonary artery is basically unsound since coronary arteries nearly always arise from the right ventricular vessel.

Negro boy, 7 months, was cyanotic from birth A switch-over anastomosis was done for transposition of the great vessels under hypothermia at 71 F (21.6 C), the vessels being occluded 22 minutes. Normal rhythm was restored after ventricular fibrillation occurred. He did well until cardiac arrest occurred 30 hours postoperatively during bronchoscopy for retained secretions. The coronary arteries arose from the right ventricular vessel, and a large ventricular septal defect existed.

The most satisfactory cooling mechanism is a blanket with circulating coils through which cool liquid is pumped After surgery the patient is rewarmed to 84 F (28 8 C) by replacing the cool fluid with warm water Spontaneous rewarming is allowed to take place above 84 F and is usually

(9) J Thoracic Surg 7 73 98 January 1954

complete in about 12 hours Anesthesia is essential in inducing hypothermia to render it painless and to reduce shivering which retards cooling Respiration must be maintained by manual compression of the breathing bag as soon as spontaneous efforts are ineffective, usually between 80 and 85 F Constant observation of the electrocardiographic record is essential.

Incisional bleeding is less profuse but just as persistent during hypothermia, and good hemostasis is essential. Standstill and fibrillation may be treated immediately or postponed temporarily during definitive maneuvers Routinely a gelatin Ringer suspension of red cells is administered directly into the aorta via a polyethylene tube throughout the period of circulation interruption. Transection of the sternum and opening of both pleurae in the fourth interspace provide an ideal approach to the right heart and great vessels

Hypothermia, especially in infants, is indicated (1) as an adjunct to orthodox surgery in severe cyanosis, (2) as a means of permitting direct approach to the great vessels, which involves interruption of circulation, and (3) as a means of performing intracardiac surgery within the right heart under direct vision. Contraindications include (1) severe myocardial damage, (2) acquired heart disease, (3) left-sided lesions requiring open technic, and (4) atrial septal defects, because effective closed technics now exist.

Surgery by Direct Vision in Open Heart during Hypothermia. Henry Swan, Irvin Zeavin, S Gilbert Blount, Jr, and Robert W Virtue[1] (Univ of Colorado) state that contrary to the belief held for centuries that the heart is a delicate organ, it has an extraordinary capacity to adjust and to withstand trauma and is amenable to surgical therapy Intracardiac surgery has been hampered by the necessity to perform the operations by the closed method, blindly guided only by feel. The use of pump oxygenators to allow the heart to be removed temporarily from the circulation is unsatisfactory because of (1) complexity and expense, (2) the material increase in magnitude of operation and (3) failure to provide a dry field for operation.

(1) J.A.M.A. 153:1081 1088 Nov 21 1953

The other avenue of approach to the open heart has been the lowering of the metabolism of the patient by induced general hypothermia to allow extension of the time that circulation may be interrupted without cardiac or cerebral damage Fatal complications are related to ventricular fibrillation and coronary air embolism.

In dogs cooled to 20-25 C in ice water followed by interruption of blood flow into the heart for 15 minutes and right auricular cardiotomy, ventricular fibrillation was reduced to about 8% by means of hyperventilation to control carbon dioxide accumulation. It was also found that the cold dog's heart could be routinely defibrillated by injection of a potassium chloride solution into the coronary circulation Coronary air embolism may be prevented by the following technic The venae cavae are occluded followed by the placement of a noncrushing clamp across the aorta and pulmonary arteries at their point of exit from the heart thus occluding the coronary arteries Following cardiotomy, the chest is flooded with Ringer's solution, allowing the heart to pump out all air bubbles before closure of the cardiotomy incision and removal of the occluding clamps.

Case 1 —Boy, 11, with isolated pulmonic stenosis and patent foramen ovale had a standard transventricular pulmonary valvulotomy without circulatory occlusion during induced hypothermia, the lowest temperature being 28 C Convalescence was uncomplicated

Case 5 —Girl, 8, with cyanotic congenital heart disease due to isolated valvular pulmonic stenosis had pulmonary valvulotomy under direct vision with circulatory arrest by inflow occlusion for 2½ minutes during hypothermia, the lowest temperature being 25 7 C Auricular fibrillation occurred and disappeared when she was rewarmed beyond 20 C Convalescence was uncomplicated.

Case 9 —Girl, 6 suffering progressive disability from a large interatrial septal defect, had direct suture of the defect during hypothermia, the lowest temperature being 22.0 C Ventricular fibrillation was treated by massage and perfusion of the coronary arteries with 0.5 mEq potassium chloride Circulatory arrest by cardiac inflow occlusion was maintained for five minutes. Massage and intracardiac injection of 2 cc. of 2% calcium chloride restored normal rhythm when cardiac arrest occurred after partial closure of the pericardium. Convalescence was essentially uncomplicated.

Cardiac operations have been performed on 15 patients while in a state of hypothermia with body temperatures ranging from 21.5 to 26 C In 13 circulation was stopped for

periods varying from 2 to 8½ minutes and the operation performed in the open heart under direct vision There was *one operative death Cooling should be done rapidly*, with warming to near normal temperatures at once following operation

[This fascinating new method of approaching the inside of the heart captivates the imagination. Further experience will be necessary before deciding which of the various methods is the best from the standpoints of safety freedom from complications and satisfactory exposure.—Ed.]

Occurrence of Subcutaneous Fat Necrosis in Infant Following Induced Hypothermia Used as Adjuvant in Cardiac Surgery is reported, presumably for the first time, by Harold A. Collins, Mildred Stahlman and H William Scott, Jr [2] (Vanderbilt Univ)

Infant, 4½ months, preparatory to cardiac surgery, was packed in crushed ice, enclosed in plastic bags, for 34 minutes, or until rectal temperature fell to 28 C On removal of the ice, end to-side anastomosis between the left subclavian and left pulmonary arteries was performed in 2 hours 22 minutes, during which rectal temperature rose to 29 C A 40 C water bath further raised the rectal temperature to 34 C within 40 minutes, after which it was restored to normal in an incubator within a half hour Despite some fever and transitory cyanosis postoperatively, he was well on discharge 14 days after surgery Six days later, both inguinal regions, the left lower abdominal quadrant, the anterior surfaces of the thighs and the posterolateral surface of the left hemithorax, right deltoid region and inner aspect of the upper arm contained *bluish, oval or* discoid, indurated areas, lobular in outline, and firm, yet elastic, in consistency Although attached to the skin, these areas moved freely over the underlying fascia. They were extremely tender Biopsy of one area disclosed necrosis and chronic inflammation of subcutaneous fat.

Low grade fever and pain were treated with corticotropin and oxytetracycline, but dyspnea, cyanosis and an angina like attack caused death. Some thinning of the subcutaneous nodules was noted Autopsy was not performed.

The specific predilection to necrosis of subcutaneous fat after hypothermia is attributed to decrease of oleic and increase of palmitic fatty acids in infant, as compared to adult, fat Oleic acid is unsaturated and fatty, with a much lower melting point than that of either palmitic or stearic acid

Surgical Correction of Atrial Septal Defects Associated with Transposition of Pulmonary Veins Wilford B Nep

(2) A n. Surg 138 880-885 December 1953

tune, Charles P Bailey and Harry Goldberg[3] (Hahnemann Med College) have observed, among their patients with atrial septal defects, five with anomalous drainage of the veins of the right lung into the right atrium, just to the right of the remnant of the atrial septum It was felt that such a defect might be repaired by suture of the redundant wall of the right atrium to the anterior edge of the atrial septal defect The suturing could then be extended superior

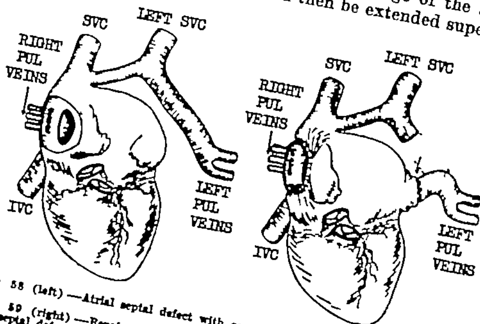


Fig 58 (left) —Atrial septal defect with complete transposition of all pulmonary veins.

Fig. 59 (right) —Repair of complete transposition of all pulmonary veins with atrial septal defect.

(Courtesy of Neptune W B., et al. J Thoracic Surg. 25:623-624 June 1953)

ly and inferiorly to the posterior extremity of the right atrial chamber, thus producing an anterior atrial compartment containing the entrance of the superior and inferior venae cavae, the coronary sinus and the tricuspid valve, and posteriorly a separate compartment containing the entrance of the pulmonary veins of the right lung which drain by way of the septal defect into the left atrium This was done successfully in the two cases in which it was tried

Woman, 41, with previous history of rheumatic fever, had joint pains, exertional dyspnea, orthopnea, nocturnal dyspnea and near syncope, especially when walking down stairs. There was a grade 1 harsh systolic murmur at the mitral area and a reduplicated second

(3) J Thoracic Surg 25 623-624 June 1953

sound. In the aortic area and along the left upper sternal border there was a harsh grade 2 systolic murmur During right heart catheterization, the catheter passed out into the right lung field at a level below the right pulmonary artery The pressure here was venous and the blood highly oxygenated, suggesting that the tip lay within a pulmonary vein. The catheter was withdrawn, then advanced through an atrial septal defect into the left atrium and out through a pulmonary vein in the left lung field. The catheter was again withdrawn and advanced into the right ventricle and through the pulmonary artery The course of the catheter established the presence of an atrial septal defect and anomalous pulmonary venous drainage into the right atrium. The oxygen content of blood from the right atrium was significantly higher than that from the superior vena cava, suggesting a left to right shunt at the atrial level. The peripheral arterial saturation was normal, indicating the absence of a significant right to left shunt.

At thoracotomy the pulmonary artery was normal and the pulmonary veins of the right lung all emptied into the right atrium. Digital examination through the tip of the right auricular appendage revealed a 1.5 cm. posterior atrial septal defect and three right pulmonary veins emptying into the right atrium. The redundant wall of the right atrium was sutured to the anterior edge of the atrial septal defect producing a large anterior chamber and posteriorly a smaller chamber containing the entrance of the three pulmonary veins in communication with the left atrium by way of the interatrial defect. There was an uneventful postoperative course, and subsequent cardiac catheterization followed a normal course

One case of atrial septal defect associated with the transposition of all of the pulmonary veins was seen. The right veins entered the right atrium as in the previous case, the left entered a left superior vena cava which subsequently joined the right (Fig 58) It is felt that this defect might be repaired by suture of the redundant wall of the right atrium to the anterior edge of the septal defect extended inferiorly and then superiorly to the posterior margin of the atrial chamber (Fig 59) Two chambers would thus be formed, the anterior containing the entrance of the vena cavas, the coronary sinus and the tricuspid valve with the posterior containing the entrance of the right pulmonary veins The posterior chamber would empty through the septal defect into the left atrium The left superior vena cava, containing the entrance of the left pulmonary veins, could be detached from its entrance into the right superior vena cava and anastomosed by suture technic to the left

auricular appendage as previously suggested by Muller

Surgical Closure of Interauricular Septal Defects.—Viking Olov Björk and Clarence Crafoord[4] (Stockholm) discuss earlier technics for closure of interauricular septal defects (blind methods, closed intracardiac tactile methods or open methods on the bloodless heart) and their use of a technic described by Söndergaard (1952) in one case.

Girl, 6, with no interauricular septum and with a huge right auricle and pulmonary hypertension, also had complicating mitral stenosis, not diagnosed preoperatively. After digital dilatation the defect, though smaller, was not closed. The child died of the operation.

This experience indicated that the surgeon must have a finger in the auricle to exclude mitral stenosis or make a valvulotomy, to exclude abnormal venous return, to guide sutures and to ascertain effective closure of the defect, and that the Söndergaard method is ineffective for repair of the very large interauricular defect or one close to the valvular plane or combined with a high interventricular defect. Using an autopsy specimen, the authors worked out a new technic for such cases.

TECHNIC.—The pericardium is opened in front of the right phrenic nerve, and the superior and inferior venae cavae are dissected free at their points of entry into the right auricle. A dissection between the superior vena cava and the superior pulmonary vein is continued down between the right and left auricular walls until the muscle bundles from the two auricles cross over from one to the other as a network. The dissection is then continued down between the inferior vena cava and the left auricle, as described by Söndergaard, but if the defect is large the dissection between the inferior vena cava and the pulmonary veins is abandoned until after palpation from within the auricle. With the finger inserted through the right auricular appendage, a long, thin, curved needle is passed through the auricular wall at the right side of the aortic root behind the right coronary artery. The needle should closely follow the aorta subendocardially without entering the aorta. With digital guidance, the needle is directed subendocardially down through the upper portion of the interventricular septum between the mitral and tricuspid valves and out through the auricular wall behind the inferior vena cava. The two ends of the suture are then drawn taut across a piece of fibrin foam in a groove already dissected between the superior vena cava and the right pulmonary vein. Effective closure is verified with the finger inside the right auricle, the suture is then tied

(4) J. Thoracic Surg. 26: 300-308, September, 1953.

The method appears applicable in all types and sizes of uncomplicated atrial septal communications, as well as in cases complicated by mitral stenosis and with atrioventricularis communis

Applying the atrial well of Gross, the authors have produced interauricular septal defects and closed them as described They have passed needles through the interventricular septum without cardiac irregularities or ECG changes. *Clamping of the anterior part of the interventricular septum* causes no irregularities, whereas clamping of the posterior part of the upper portion of the interventricular septum (including the bundle of His) does Since the bundle of His comes from the right auricle over on the right side of the posterior portion of the interventricular septum, *the* needle should be guided to the left as it passes through the posterior portion of the interventricular septum and taken out through the left auricular wall behind the inferior vena cava as near the atrioventricular border and interventricular septal plane as possible Three patients have been operated on successfully by this method

Cardiac Arrest during Surgery, according to Frank Glenn[5] (New York Hosp Cornell Med Center), occurred once in every 2,000 operations in three New York hospitals. A reasonable estimate of the number of cardiac arrests during surgery in one year throughout the United States would be 5,000 There is general agreement that cardiac arrest is associated with decreased oxygenation of the myocardium through the coronary circulation and through vagal stimulation. Factors which may contribute to this situation include inadequate supply of oxygen to the blood in the pulmonary circulations, a diminished flow of blood through the lungs because of pre existing anemia, hemorrhage, shock or occlusion of vessels as in heart surgery and vagal stimulation Precautionary measures during surgery include the sparing and cautious use of preanesthetic preparations which may depress respiration and the maintenance of adequate air flow and good oxygenation. When cardiac arrest has been diagnosed, two objectives should be sought

(5) Ann. Surg. 137 920 024 J ne 1953

at once The first is to establish an adequate airway and the second to re-establish cardiac action If the patient has an endotracheal tube, controlled ventilation with 100% oxygen should achieve the desired results If an endotracheal tube is not in place, artificial ventilation should be instituted by means of a mask and bag or by mouth to mouth insufflation If ventilation is not adequate by these means, the patient should be intubated

While the airway and controlled respirations are being established, the chest should be opened through the left fourth or fifth interspace without regard to asepsis or control of bleeding A scalpel is the only instrument needed. When the chest is open, the constricting effect of the ribs on the surgeon's wrist can be controlled with a wedge Cardiac massage should be instituted immediately to produce palpable peripheral pulsations at the rate of 60-70 a minute In these circumstances, 90% of cardiac standstills will probably respond. Should the heart fail to respond, introduction of 0.25 cc of 1 1,000 epinephrine into cardiac chambers is advocated by some A dose of 2 cc of 2% procaine may also be helpful. If ventricular fibrillation does not respond to cardiac massage, an electric current of 110 volts run through a defibrillator for two seconds may restore normal cardiac contractions Cardiac resuscitation may take place within a few minutes or it may be delayed for many minutes Once regular cardiac contractions are re-established the heart is likely to continue satisfactorily If, however the brain is deprived of oxygen for three to five minutes brain damage will be irreparable

Cardiac arrest is most common during intrathoracic surgery However resuscitation can be accomplished quickly in such situations because the chest is already open and an endotracheal tube is usually in place

A plan of action in case cardiac arrest occurs should be ready in all hospitals and all professional personnel directly involved in surgical procedures should be familiar with the plan of action. All equipment necessary for the resuscitation of the patient and an instruction sheet should be readily available to all personnel.

[To the older surgeons there seems little doubt that cardiac arrest is much

more frequent than formerly It seems reasonable to blame, in part at least, the complicated newfangled methods of anesthesia. There is increasing evidence that the condition is induced by inadequate pulmonary ventilation.—Ed.]

Cardiac Arrest and Ventricular Fibrillation Experimental Study in Dogs with Acute Hypoxia and Hypercapnia and in Dogs with Chronic Hypoxia. B D Stewart, Robert W Virtue and Henry Swan[6] (Univ of Colorado) studied the effect of hypoxia and hypercapnia on temporary cardiac arrest resulting from vagal stimulation in normal and in chronically hypoxic dogs and also investigated the effect of these conditions on cardiac arrhythmias induced in dogs by cyclopropane anesthesia with administration of epinephrine

Method.—The left vagus nerve was isolated for a short distance near the arch of the aorta in 19 normal dogs. The dogs were allowed to breath (1) 50% O_2 and 50% N_2 (with resulting normal O_2 and CO_2 tissue saturations when mild hyperventilation was carried out), (2) 10% O_2 and 90% N_2O (with resulting hypoxia) and (3) 50% O_2, 20% CO_2 and 50% N_2O (with resulting hypercapnia) Vagal stimulation was carried out after the dogs had breathed each of the mixtures for at least 10 minutes, until cardiac arrest followed by spontaneous escape had occurred.

Various procedures, including pulmonary arteriovenous fistula, anastomosis of pulmonary artery to left auricle and partial pulmonary artery stenosis, and tricuspid insufficiency combined with interauricular septal defect, were used to produce chronic hypoxia in nine dogs. Vagal stimulation with use of the foregoing breathing mixtures was done on these dogs after they had lived in a hypoxic state from six weeks to five months.

Ten normal dogs were allowed to breathe cyclopropane-oxygen mixture in a closed system with a soda lime chamber in the system for about 20 minutes. Three gas mixtures were then used (1) 10% cyclopropane and 90% O_2, (2) 10% cyclopropane, 10% O_2, 80% N_2O and (3) 10% cyclopropane, 30% O_2, 20% CO_2 and 40% N_2O During administration of mixture 3, the soda lime chamber was removed. After the animals breathed each of these mixtures for about 10 minutes, an arrhythmia producing dose of epinephrine was given intravenously

The duration of cardiac arrest during hypercapnia was consistently two to five times longer than during normal respiration or during acute hypoxia. In acute hypoxia the dogs were cyanotic but before vagal stimulation cardiac action was not altered However when dogs were made

(6) A.M.A. Arch. Surg. 66 703 713 June 1953

acutely hypercapnic, slowing of the heart rate and apparent weakening of contractions was noted.

The most profound chronic hypoxia was produced by anastomosis of the pulmonary artery to the left auricle with stenosis of the artery distal to the shunt, this also was accompanied by the highest mortality The least wasteful method of causing significant arterial oxygen desaturation proved to be formation of interauricular septal defect with tricuspid insufficiency

It appears that hypercapnia, which enhances vagal cardiac arrest in the normal dog, does not have this effect in the chronically hypoxic dog Acute hypoxia appears to make cyclopropane-epinephrine arrhythmias more prolonged, whereas hypercapnia does not seem to have any specific influence In one third of the chronically hypoxic dogs ventricular fibrillation was induced by vagal stimulation, whereas this arrhythmia did not occur with vagal stimulation in previously normal dogs

Cardiac Arrest in Infants and Children Report of 66 Original Cases William H Snyder, Jr., Monica H Snyder and Lawrence Chaffin[7] report on 8 cases seen at Massachusetts General Hospital during 1924 29 and 58 cases seen at Los Angeles Childrens Hospital during the last 18 years Of the second group, 23 were encountered in patients in the general surgical services and 35 in patients with cardiac conditions In the general surgical group there was an incidence of one arrest in 2,504 operations In the past 5 years the incidence has increased to one in 1,128 operations or four times that of the previous 15 years Cardiac arrest in infants and children is 156 times as frequent in cardiac surgery as in general surgery

Anoxia or vagovagal reflex or both are probably responsible for and explain the mechanism of stoppage of the heart in most cases It seems possible that the dead space and respiratory resistance in the tubes leading from the mask may be responsible for hypoxia or hypercapnia in these small children.

The order of frequency of encountering cardiac arrest in the different surgical specialties is thoracic, general, plas-

(7) A.M.A. Arch. Surg 66 714 729 June 1953

tic, ear, nose and throat, endoscopic, orthopedic, neurologic and genitourinary

When the chest is open the surgeon observes cardiac arrest immediately When the chest is not open, failure to hear

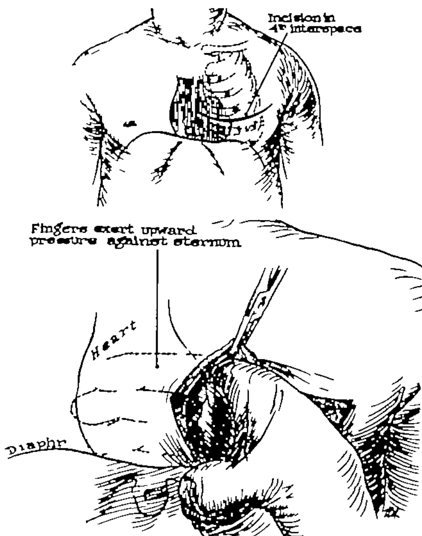


Fig. 60 (top) —Incision.
Fig 61 (bottom) —Compression of heart against sternum.
(Courtesy of Snyder W H, J et al A M.A. Arch. Surg 66 714 720 June, 1953)

the heart sounds, to feel the pulse or obtain the blood pressure or to palpate pulsations in a large vessel have been the main diagnostic signs of arrest utilized by the anesthetist and the surgeon. In infants, before administration of the anesthetic is begun a stethoscope should be strapped to

the precordium with adhesive tape The anesthetist can thus be aware of the *first audible evidence of arrest* If the pulse rate and blood pressure cannot be obtained and heart sounds cannot be heard, the chest should be opened and the heart exposed for final diagnosis and treatment.

Baby, aged 3 weeks, during the final stages of an operation for sacrococcygeal tumor was noted to have no audible heart sounds. Pressure inflation and deflation of the lungs with pure oxygen was administered by manual compression of the rubber bag An incision was made in the fourth interspace (Fig 60) and the heart exposed. There were no contractions. The heart was compressed rapidly, about 80 times a minute, against the sternum with three fingers inserted through the opening in the chest (Fig 61) After several periods of massage, administration of blood and injection of 0.2 cc. of 1 1,000 epinephrine diluted 10 times with saline, the heart resumed its normal rhythm. The chest was closed and the operation completed. The child recovered uneventfully and has shown a normal mental development

Before adoption of the present plan of management, no *child lived, now 25% have completely recovered.*

Primary Cardiac Tumors in Infancy Luther A. Longino and Irving A. Meeker, Jr [8] (Children's Hosp, Boston) state that the commonest primary heart tumor is the myxoma, which occurs at any age Rhabdomyoma is the only primary heart tumor that has a definite predilection for younger age groups, particularly children with tuberous sclerosis The signs and symptoms of myxomas vary widely, depending on the patient's age, but ultimately they lead to *irreversible* cardiac failure which does not respond to therapy Most myxomas are in the atria, more frequently the left atrium, and tend to proliferate and project into the heart chambers, thus preventing normal cardiac filling, and to obstruct the mitral or tricuspid valves The origin of these tumors is controversial but the auricular septum is believed the most likely site

Primary sarcomas of the heart are slightly less *common* than myxomas but occur in all ages They are commonly located in the right auricle or right ventricle and usually infiltrate the wall of the myocardium and extend outward into the pericardial cavity frequently involving the pericardium They arise from mesenchymal tissue and are vari

(8) J Pediat. 43 4 731 December 19 3

able histologically Other rare cardiac tumors are angioma, fibroma, lipoma and hamartoma.

Infants with primary cardiac tumors are usually normal at birth, without evidence of cardiomegaly, tracheal or esophageal obstruction or cyanosis As the tumor proliferates intra or extracardially, there are signs of irritability, failure to gain weight, coughing, respiratory retraction, cyanosis, cardiomegaly and, ultimately, cardiac failure The cardiomegaly must be differentiated from the infantile cardiac form of von Gierke's disease, idiopathic myocarditis, endocardial sclerosis or the generalized cardiac dilatation which occurs in certain types of severe congenital heart disease The cyanosis must be differentiated from that caused by congenital heart disease, vascular ring anomalies or intrinsic or extrinsic abnormalities of the trachea or esophagus Angiocardiography is often confirmative Prognosis is poor unless diagnosis is made early

Boy, aged 3 months, was normal at birth, but at age 2 months ate poorly, did not gain weight and had a weak cry and episodes of severe coughing, during which he became cyanotic and apneic. He was thought to have an enlarged thymus and was treated by radiation without improvement Cardiac fluoroscopy revealed a large mass in the middle of the chest. The neck veins were distended, but there was no peripheral edema. The entire anterior chest was dull to percussion, and breath sounds were absent except in the right midaxillary thoracic region The heart was enlarged or pushed to the left The liver was palpable. Barium swallow showed the esophagus and trachea displaced to the right, suggestive of a pericardial effusion

Exploratory *thoracotomy revealed a large myxomatous tumor originating from the upper border of the right ventricle, where it* joined the right atrium. Frozen sections revealed a malignant myxoma of the heart It was not possible to resect the entire tumor, but much of it was removed from the pericardial sac. The infant had marked symptomatic improvement. Angiocardiography 10 days after operation failed to reveal intracardiac filling defects After the child was discharged from the hospital anorexia, vomiting, cyanosis and coughing recurred An x ray revealed rapid growth and extension of the sarcoma to the mediastinum and lung The infant died, and autopsy revealed involvement of the pericardium, lung, thoracic inlet and diaphragm. The surgical specimen resembled a myxosarcoma, whereas tissue obtained at autopsy resembled a fibrosarcoma with definite areas of rhabdomyosarcoma.

Splanchnicectomy for Essential Hypertension Results in 1,266 Cases are detailed by Reginald H. Smithwick and Jesse E Thompson[9] (Boston Univ) The patients were followed 5 14 years. During this period, operation had been offered to 467 patients who declined, these patients were followed 5 11 years. All in both groups had persistent hypertension (blood pressure in the horizontal position 140/90 mm. Hg or

TABLE 1—NUMERICAL VALUE OF VARIOUS FACTORS THAT INFLUENCE PROGNOSIS

FACTOR	NUMERICAL VALUE
Cerebrovascular accident with or without minor residual	1
Abnormal ECG	1
Enlarged heart	1
Impending congestive failure	1
Phenolsulfonphthalein excretion, less than 25% in 15 min. or less than 60% in 2 hr	1
Age 50 or over	1
Mild angina	1
Cerebrovascular accident, with residual*	2
Frank congestive failure, moderate angina	2
Phenolsulfonphthalein excretion, less than 20% in 15 min.	2
Unsatisfactory response to sedation	2
Phenolsulfonphthalein excretion, less than 15% in 15 min.	3
Nitrogen retention	4

* Cerebral deterioration or definite involvement of arm and/or leg.

more) Most patients had evident vascular disease manifest in the eyes, heart, kidney or brain.

Patients with similar degrees of hypertension and of cardiovascular involvement were placed in comparable groups to provide a basis for comparison. This was done by assigning a numerical value to various factors having a bearing on prognosis (Table 1) Numerical values were totaled to obtain a numerical grade for each patient, and on the basis of this grade, patients were classified into groups (Table 2)

Evaluation of efficacy of the thoracolumbar sympathectomy and splanchnicectomy was based on survival (Table 3)

(9) J.A.M.A. 152 1501 1504 Aug 15 1953.

TABLE 2.—CLASSIFICATION OF HYPERTENSIVE PATIENTS

Group	Numerical Grade	Other Factors
1	Less than 4	Eyegrounds grade 0 or 1* No changes in cerebral, cardiac, or renal areas
2	Less than 4	Eyegrounds grade 0 or 1 with changes in cerebral, cardiac, and/or renal areas. Eyegrounds grade 2, 3, or 4 with or without changes in cerebral, cardiac, or renal areas*
3	4 or more	Resting diastolic level below 140 mm. Hg. Changes are present in cerebral, cardiac, and/or renal areas, but they do not include the following Cerebrovascular accident, with marked residual Frank congestive failure Phenolsulfonphthalein excretion, below 15% in 15 minutes, associated with a poor response to sedation
4	4 or more	Resting diastolic blood pressure below 140 mm. Hg combined with one or more of the following Cerebrovascular accident, with marked residual Frank congestive failure Phenolsulfonphthalein excretion, below 15% in 15 minutes combined with a poor response to sedation Patients with a resting diastolic level of 140 mm. Hg or more

Eyegrounds are graded according to the criteria of Keith, Wagener and Barker

TABLE 3.—MORTALITY FOR MEDICALLY AND SURGICALLY TREATED HYPERTENSIVE PATIENTS*

Group	Medical Series		Surgical Series	
	Cases	Mort. at 5 Yr	Cases	Mort. at 5 Yr
1	62	19%	158	8%
2	200	38%	735	13%
3	108	71%	244	20%
4	97	90%	129	59%
Total	467	54%	1,266	19%

Statistical analysis of the comparative five year mortalities between the medical and surgical groups follows

Group	Chi²	p	Comment
1	4 92	0 03	Significant
2	60.6	<0.001	Highly significant
3	83.2	<0 001	Highly significant
4	24 6	<0 001	Highly significant

Yates correction used throughout.

On the basis of these results, the authors recommend splanchnicectomy as the treatment of first choice in groups 2 and 3 If renal function is adequate and the patient is a satisfactory surgical risk, operation may be recommended even for those in group 4 At the present time, the only reliable basis for selection of patients for operation is the effect that surgical treatment is known to have on the life expectancy of patients in each of the four groups Drugs and diet probably should be tried in group 1, especially if the patient is a woman, operation may well be preferred for men Diet and drug therapy as well as surgery may have to be used for refractory patients in groups 2 and 3

All of these patients were first seen or operated on before introduction of hypotensive drugs and diets. Some of the surgical patients have had diets and drugs in recent years The medical patients have had all available forms of current therapy Whether hypotensive drug therapy will be as effective as operative treatment is unclear

Total Thoracic and Partial to Total Lumbar Sympathectomy, Splanchnicectomy and Celiac Ganglionectomy for Hypertension. Previous reports have shown that splanchnicectomy does not significantly interrupt sympathetic vasopressor pathways regulating blood pressure and have described the extent to which sympathetic regeneration could occur, particularly when celiac or other large ganglions were not removed Because of this evidence, Keith S Grimson, Edward S Orgain, Banks Anderson and George J D'Angelo[1] (Duke Univ) planned total sympathectomy for hypertension Denervation of the heart, other thoracic viscera, head, arms and upper body with adequate protection against regeneration requires removal of the stellate ganglion along with the upper thoracic chain Denervation of the splanchnic area is effected by removal of the lower thoracic chain, splanchnic nerves and upper one or two lumbar ganglions with complete or partial celiac ganglionectomy This procedure leaves the legs with some sweating and vasoconstriction Accordingly, surgical total sympathectomy is not completely physiologically Experience in 172 cases is reported

TECHNIC —Blood rather than vasopressor drugs is used as the

(1) Ann Surg 138 532 547 October 1953

main support during operation. Through an upper incision, centered through the bed of the third rib in the midaxillary line, the stellate and upper six or seven thoracic ganglions and sympathetic chain are freed. This incision is closed and a second made through the 10th rib bed, centering a little posterior to the midaxillary line. The nerves and chain are freed to the diaphragm the posterior attachment of which is partially detached and elevated exposing the upper lumbar sympathetic ganglions. The 1st and 2d ganglions are removed. The greater splanchnic nerve is tugged, the diaphragm opened and the celiac ganglion removed. Aspiration is performed for three days postoperatively by constant suction. The second stage is done at least three weeks later

Postural hypotension is seldom a serious problem. Unlike conventional splanchnicectomy, total sympathectomy eliminates compensatory tachycardia, pallor and sweating of the upper body while standing, and usually leaves some vasoconstriction in the legs The bilateral Horner syndrome is not a concern Congestion of nasal mucosa and absence *of vasoconstriction have been bothersome More than half* the patients in this series required some treatment for improvement of the nasal airway

Of 19 patients who had sympathectomies, 3 died at operation and 9 were living 10-18 years later Each of the nine was working with little or no disability There was one operative death among 95 patients undergoing sympathectomy over five years previously with 79 living 5-10 years after operation Significant reduction of blood pressure persisted in 65 8% In the past five years 58 patients were treated by sympathectomy There were 2 operative deaths 52 were alive *Of the 172 patients treated by total* thoracic sympathectomy splanchnicectomy and partial to complete celiac ganglionectomy 3 5% died at operation 15 1% died later and 81 4% were living

The preoperative conditions of patients who died within three years usually indicated advanced organic vascular disease, this cannot be considered an absolute contraindication to operation but is indicative of a poor prognosis Survival rates definitely surpassed those of reported follow up *studies of hypertensive patients not treated surgically* and slightly surpassed those following splanchnicectomy

Clinical Course, Following Adrenal Resection and Sympathectomy, of 82 Patients with Severe Hypertension. William A. Jeffers, Harold A. Zintel, Joseph H. Hafkenschiel, A. Gorman Hills, Alfred M Sellers and Charles C Wolferth[2] (Univ of Pennsylvania) report on 82 patients operated on before Dec 31, 1952 and followed for 1-38 months Subtotal and total adrenalectomy was performed with and without various types of sympathectomy Fifty four patients had an Adson type of sympathectomy and either subtotal or total adrenalectomy The operations were performed through a subdiaphragmatic, retroperitoneal approach, in two stages about 10 days apart Operative mortality was 6%

The tentative indications for operation were (1) average diastolic blood pressures of 120 mm. Hg or more, (2) failure to respond to intensive medical therapy, and (3) evidence of progressive vascular damage Tentative contra indications were (1) poor renal function, with excretion of less than 20% of phenolsulfonphthalein 15 minutes after intravenous injection, blood urea nitrogen content over 20 mg /100 ml., or both, (2) convalescence from a stroke or coronary occlusion for less than six months, (3) age, 55 years or more, and (4) inability to co-operate with a careful follow up program because of intellectual deficits or emotional instability

A favorable response to subtotal adrenalectomy, with or without sympathectomy, is uncommon unless enough tissue has been removed to make the patient susceptible to adrenal insufficiency when cortical replacement therapy and salt are withdrawn. It is simpler to remove all of an adrenal gland than to leave a fragment adjacent to the adrenal vein.

Among the 82 severely hypertensive patients operated on, the response was excellent in 23%, fair in 14% and poor in 32% Although 21% failed to survive, only one patient died of uncomplicated adrenal insufficiency Those with paroxysmal dyspnea or congestive heart failure have shown the most striking improvement after operation Among the objective changes observed were reduction of heart size in 41% improvement in ocular fundi in 48% and improvement in ECG tracings in 27%

(2) Ann. Int. Med. 39 254 266 August, 1953.

PERIPHERAL ARTERIES AND AORTA

Thromboangiitis Obliterans Clinical Diagnosis and Classification of Cases R L Richards[3] (Univ of Glasgow) summarizes the current view regarding the differential diagnosis between thromboangiitis obliterans and arteriosclerosis obliterans Thromboangiitis obliterans may be diagnosed with some certainty in a man with occlusive arterial disease who was under age 35 at the time of initial symptoms, giving a history of superficial phlebitis and with involvement of the upper limbs If the patient is over 50, with disease confined to the lower limbs, with some *hypertension* and x ray evidence of arterial calcification, arteriosclerosis may be diagnosed confidently This leaves many patients in an intermediate group who are 35-45 years of age with normal blood pressure, normal vessels, no history of phlebitis and disease confined to one or both lower limbs

Difficulty in classification of the last group led Richards to review the case histories of 85 patients for whom a diagnosis of thromboangiitis obliterans had been made Ages ranged from 21 to 56 and 84 were males All smoked, but few were heavy smokers Only one was Jewish. Superficial thrombophlebitis occurred in 32% Blood pressure higher than 150/90 was registered in 15 patients The arteries showed no calcification on x ray studies

It was possible to divide the series into five groups (1) acute, 18 cases, (2) episodic 28 cases, (3) slowly progressive, 25 cases, (4) acute arterial occlusion, 15 cases, and (5) upper limbs, 4 cases An alternate classification according to the site of the arterial lesion covers (1) the proximal type (19 cases) with occlusion in a main artery of the limb with calf muscle claudication the main symptom, (2) distal type (30 cases) with disease beginning in the arteries of the foot, pain in the foot the presenting symptom, more rapidly progressive and (3) a mixed type (36 cases)

With the possible exception of superficial phlebitis, none of the clinical features is pathognomonic of thromboan

(3) Brit. M. J 1 478-481 Feb 28 1953

gitis obliterans The diagnosis must often depend on the natural history of the patient's illness In the past, too much emphasis has been placed on such criteria as race, age and involvement of the upper limbs The value of association with tobacco smoking and the male sex is lessened by the universal nature of the smoking habit and the fact that, except in diabetics, all forms of obliterative arterial disease are commoner in men than in women.

Surgical Considerations of Excisional Therapy for Aortic Aneurysms. Denton A. Cooley and Michael E DeBakey[4] (Baylor Univ) consider aneurysm of the aorta fatal and urge prompt treatment but have found no operation—intended to obliterate the aortic aneurysm by promoting thrombosis within the sac through ligation, introduction of foreign matter or stimulation by periarterial fibrosis—satisfactory, and only rarely curative. Cellophane wrapping of the aorta not only has limitations but may even be harmful.

Excision is the most effective surgical treatment for aneurysm, the choice of method will vary with the type of lesion, particularly when it is sacciform or fusiform. If sacciform, aortic continuity may be preserved by tangential excision of the sac and suture of the defect, if fusiform, resection of an entire segment and restoration of the continuity of aortic flow by arterial homograft or suitable plastic prosthesis are necessary

Aneurysmectomy for sacciform aneurysms of the thoracic portion of the aorta consists primarily of careful mobilization of the neck of the aneurysm in preparation for occlusion, and application of a suitable clamp to the neck of the lesion. After complete mobilization from surrounding structures, the aneurysm, with a cuff of tissue left in the clamp is excised The neck of the aneurysm may be sutured with a double row of interrupted 000 black silk sutures with a proximal row of mattress sutures and distal row of figure of-eight sutures over the ends of the cuff Removal of the clamp usually causes some bleeding from needle holes but this ceases spontaneously Excision is fairly uniform in sacciform lesions of the thoracic portion of the aorta, but the approach may vary with its exact location The proximal

(4) Surgery 34 1005 10 0 December 1953

part of the aorta along the arch can best be approached by anterior thoracotomy

Aneurysms of the lower thoracic and upper abdominal portions of the aorta are usually of syphilitic origin and sacciform type, aneurysms of the lower abdominal portion of the aorta are usually arteriosclerotic in origin and fusiform in type Lower thoracic and upper abdominal aortic fusiform aneurysms can best be reached by left thoraco-abdominal approach through the resected bed of the 9th or 10th rib The aorta proximal and distal to the aneurysm is mobilized and freed enough to permit application of occluding clamps, whereupon the aneurysm and involved aortic segment between the clamps are excised, a suitable aortic homograft is used to bridge the defect in the aorta. Aneurysms arising in the abdominal aorta below the renal arteries are approached through midline abdominal incision

Such resection and replacement with aortic homografts has been performed 13 times, except for one in the lower thoracic aorta, the aneurysms were all below the renal arteries, 11 were of arteriosclerotic and 2 of probable syphilitic origin. All of the abdominal aortic aneurysms were fusiform, in nine they involved, and therefore required resection of, the bifurcation.

The postoperative course was uncomplicated except in the patient who died. No evidence of ischemic change as a result of the temporary occlusion of the aorta during resection and anastomosis was found. Although follow up does not suffice for final evaluation, the method of therapy seems to be satisfactory

Refrigeration in Experimental Surgery of Aorta. According to Edward J Beattie, Jr, Dominic Adovasio, John M Keshishian and Brian Blades[5] (George Washington Univ) experimental reconstruction of the thoracic aorta has shown that hindquarter paralysis may follow temporary occlusion of the thoracic aorta. The effect of refrigeration during occlusion of the thoracic aorta in the dog was studied. The dogs were anesthetized with nembutal® and refrigerated in a bed of crushed ice covered with plastic sheeting until rectal temperature dropped below 30 C

(5) Surg. Gynec. & Obst. 96 711 712 June 1953

Of 10 dogs not refrigerated, 4 had signs of hindquarter paralysis after the thoracic aorta had been occluded for 60 minutes There was one questionable instance of weakness of one hindleg among 10 dogs refrigerated while the thoracic aorta was occluded for 90 minutes Of 10 dogs that died during the refrigeration experiments, 7 died of cardiac arrest or ventricular fibrillation. Rectal temperatures below 25 C were particularly likely to cause cardiac arrest or ventricular fibrillation. Large doses of nembutal® were poorly tolerated by the refrigerated dog That refrigeration will protect the spinal cord against temporary anoxia is indicated, but safer methods of refrigeration are needed

Use of Gelfoam for Support as Well as Hemostasis in Vascular Surgery In 1950, fabrication of tubular fresh autogenous arterial grafts suitable for replacing a portion of the aorta was investigated in dogs The grafts were wrapped with Gelfoam after being sutured in place The microscopic changes in dogs killed up to one year after operation have been so consistent and striking according to Elliott S Hurwitt[6] (Montefiore Hosp., New York City), as to suggest additional uses for this material in vascular surgery

TECHNIC.—Large dogs were subjected to splenectomy, including a long segment of the splenic artery This vessel was opened in its long axis and divided transversely into three or four equal panels. A tubular structure with a diameter approximating that of the abdominal aorta was fashioned by sewing the pieces together The fabricated graft was used to replace a segment removed from the abdominal aorta distal to the renal arteries The graft was wrapped in one layer of compressed or regular Gelfoam, size 100, and the posterior parietal peritoneum and abdomen were closed.

Use of this type of graft lessens the need for a vessel bank, and its long term viability contrasts favorably with the collagenous degeneration characteristic of homografts Gelfoam acts to minimize blood loss and to minimize the possibility of subsequent bursting

Specimens examined at four days showed the Gelfoam loosely adherent to the graft and of soggy consistency From the 10th day the line of cleavage was obliterated From 99 to 370 days there was no demonstrable difference in wall thickness and the consistency of the tissue was quite simi

---

(6) Angiology 4:418-428 October 1953

lar Microscopic changes indicated that the Gelfoam grad ually disintegrated, with the appearance of fibroblasts, collagen and macrophages The sponge seemed to serve as a scaffolding for newly formed connective tissue At 65 days, the new adventitia has the consistency of fibrous tissue "Absorption" of Gelfoam was completed between 65 and 99 days, and from 99 to 370 days there was a gradual increase in density of the adventitia with a decrease in the number of blood vessels No difference in the fate of compressed and regular Gelfoam could be discerned

Although no demonstrable Gelfoam is found after two to three months, restoration of normal tissue integrity does not result as there is invasion of the Gelfoam by granulation tissue, with subsequent conversion to fibrous tissue

This fibrosis may be useful in clinical cardiac surgery, thrombendarterectomy, secondary hemorrhage and other vascular conditions, but it constitutes a contraindication to use of Gelfoam in relation to gastrointestinal suture lines If further study demonstrates that the fibrosis interferes with growth of the vascular anastomotic suture lines in young animals, the usefulness of Gelfoam in pediatric vas cular surgery will be limited

Freeze-Dried Arterial Homografts Clinical Application. According to Robert B Brown, Charles A. Hufnagel, James W Pate and W Ronald Strong[7] (Nat'l Naval Med. Center), storage of arterial homografts preserved by freeze-drying does not require supervision by specialized personnel, nor depend on controlled temperatures, storage mediums or sterility, it is also independent of power failure and most extrinsic influences Moreover the grafts are easy to store and handle, and have a shelf life exceeding two years

Sections of arterial homografts, obtained at sterile au topsy from bodies without transmissible disease, are studied bacteriologically and microscopically The vessel segments are then placed in glass tubes and frozen by immersion for five minutes in a mixture of absolute alcohol and dry ice at —78 C, after which they are either placed in a freeze drying machine or stored at dry ice temperature to await freeze-drying An extensively modified commercial freeze

(7) Surg., Gynec. & Obst. 97 657 665 December 1953

drying machine is used for drying and the grafts are placed in a vacuum of 50-100 microns of mercury A temperature under —35 C is maintained for several hours The entire procedure takes about 72 hours During the last 24 hours of the cycle the temperature is raised to 30 C After the drying is completed, residual moisture in the graft is reduced to less than 1% of the normal unbound water content The grafts, sealed in bottles under ionizable vacuum, are stored at room temperature

For implantation, the vessels are reconstituted by immersion in a large volume of physiologic saline solution containing penicillin and streptomycin After 30 minutes in this solution at body temperature the vessels, although nonviable, have regained all physical properties of the fresh artery In animals, the incidence of complicating thrombosis and hemorrhage has been lower and replacement of the freeze-dried graft with host tissue more rapid and there has been less foreign tissue response than with use of fresh arterial homografts.

This is the first report on use of freeze-dried homografts in man. In seven patients, the 12 vessel segments implanted included the femoral artery, the common iliac, the abdominal aorta, common iliac with bifurcation, lower thoracic aorta, common iliac with external iliac and lower abdominal aorta and common iliac arteries with their bifurcations. Follow up for one to nine months has disclosed that the patency of all 12 grafts has apparently been maintained

Such grafts have been used in the treatment of aneurysms of major vessels including the aorta, coarctation of the aorta and segmental occlusive disease of major vessels. Their use in the treatment of both malignant invasion and traumatic lesions of major vessels is conceivable, as is also the feasibility of their use in the field of military surgery

Arterial Homograft Bank. J D Mortensen, John H Grindlay and John W Kirklin[6] state that many surgical procedures require arterial grafts. The fate of arterial grafts has been extensively studied Vascular autografts (transplantation of a segment of vessel to a new site in the same person) often remain viable, and the cells of the

(6) Proc. Staff Meet., Mayo Clin. 28 13-18 Dec. 16 1953

grafted segment continue to grow in their new location. The arterial homograft probably never "takes" in such a manner and serves merely as a functionally satisfactory tube which transports blood At the same time it furnishes scaffolding or framework on which the recipient can lay down tissue which in time will function as a new segment of artery Arterial homografts are used in treatment of coarctation of the aorta, aortic aneurysms, thrombotic oc clusion of the terminal aorta, arteriovenous fistula, trau matic damage to an artery and in shunt operations in the thoracic great vessels

The first problem in establishing an arterial bank is a supply of donors The graft must be taken a few hours after death. The donor must be relatively young and free from disease that might conceivably be transmitted with the homograft to the recipient, and the aorta must be sterile The entire aorta, from the arch to beyond the bifurcation, should be removed under strictly aseptic conditions, washed in sterile saline and inspected for defects grossly and mi croscopically The saline washing solution should be cul tured The grafts can be stored by the nutrient medium refrigeration method or by some rapid freeze method. In the former, the graft is placed in Ringer's or Tyrode's solu tion to which has been added 10% fresh homologous se- rum and then stored in an ordinary electric refrigerator at 2-4 C Grafts can only be preserved for about six weeks by this method The rapid freeze method is cumbersome and the grafts sometimes have an increased tendency to thrombosis However they can be stored for prolonged periods, probably months With adequate technical care, assuring rapid freezing and thawing sufficiently low tem peratures and avoidance of partial dehydration or crystal lization, the grafts are as satisfactory as those preserved by the refrigeration method Both methods are used at the Mayo Clinic Careful records and controls are kept of all grafts

At the time of implantation the graft must be elastic, tough and have a smooth normal appearing intima. In the operating room, a segment of the graft is selected which fits the defect All branches arising from this segment are

ligated at their exit from the graft, and the graft is kept moist in isotonic saline until it is implanted.

Preparation and Preservation of Arterial Homografts Experimental Study P L Brunnen[9] has grafted abdominal aortic segments of dogs in four ways (1) frozen grafts, (2) grafts infected, frozen, irradiated and stored frozen, (3) grafts stored in Formalin, (4) grafts placed temporarily in Formalin, then frozen.

The specimens of abdominal aorta, obtained within an hour after the animal's death, were frozen at —75 C and stored at —20 C Segments in the second group were removed without aseptic precautions and contaminated bacterially After quick freezing, the grafts were irradiated with an electron beam to a dosage of 1,500,000 rep and stored at —20 C From 1 segment out of 16 it was possible to grow the original contaminant. The third group specimens were removed without aseptic precautions and stored in 4% Formalin buffered to pH 5 6 Before use the segment was transferred to normal saline for 48 hours Segments in the fourth group were kept in Formalin for 48 hours, transferred to saline for 24 hours, quick frozen to —75 C and stored at —20 C

The grafts were observed in 22 cases Results in the simple frozen cases were uniformly good. The results in the irradiated grafts were better when irradiation was given over a shorter time, but the results were too risky to attempt irradiated human grafts More work needs to be done on Formalin storage There were good to excellent results in four of six cases Brief immersion in Formalin to deal with surface contamination may provide an answer to the problem of segments removed without aseptic precautions

The use of antibiotics to combat contamination is limited When favorable circumstances permit, and if importance is attached to viability of the graft cells, it may be preferable to store a particular segment for a special case in a balanced salt solution.

Resection of Acquired Coarctation of Low Thoracic Aorta and Replacement with Preserved Vessel Graft are described

---

(9) Guy's Hosp Rep. 102 194 03 19 3

by Ralph A. Deterling, Jr[1] (Columbia Univ Presbyterian Med Center)

Woman, 23, was seen first in 1948 because of nausea and epigastric discomfort. Blood pressure in both arms was 140/80 and femoral and dorsalis pedis pulses were palpable though weak. By October 1951, blood pressure was 190/100 in the right arm and 190/95 in the left, with striking difference in radial pulses and no detectable dorsalis pedis pulses. X ray showed a normal chest. In November, angiocardiography disclosed an elongated 9 cm. narrowing of the aorta opposite the 9th and 10th thoracic vertebrae. The left subclavian artery was not visualized She had anginal discomfort. At thoracotomy the long narrowed segment was found just above the diaphragm. The overlying pleura was thickened and adherent to the adventitia. The entire intrathoracic portion of the left subclavian artery was obliterated and appeared to be a fibrous cord. The intercostal arteries were normal except for two pairs distal to the point of maximal narrowing, which were dilated to twice normal size The segment was resected and replaced by a perfectly matching homograft. Blood flow through the graft was excellent. Continuous recordings of intra arterial brachial and femoral pressures made during operation revealed striking improvement in cardiovascular dynamics when aortic blood flow was restored. A linear fracture of the aorta where the proximal clamp had been placed caused no leakage. Study of the excised segment showed gradual narrowing to a midpoint where there was localized stenosis There was thickening of the intima and adventitia.

Postoperatively, 35 mg heparin was administered every three hours. On the fourth day she had left chest pain posteriorly and blood pressure fell to 110/50 Infusion of 500 cc. whole blood restored blood pressure. Anticoagulant therapy was immediately stopped. X ray disclosed moderate left hemothorax, which regressed during the next two weeks. She was discharged Jan. 7, 1952 with palpable dorsalis pedis pulses and blood pressure of 120/80 in the right arm. An anginal attack 12 days later was treated with nitroglycerin X ray in March revealed complete resolution of the hemothorax By February 1953, she was symptom free.

Although surgical repair of coarctations at the usual site is no longer rare, only five cases operated on for stenosis just above the diaphragm have been found in the literature The graft used by the author had been removed 12 days previously and preserved at 4 C in Hank's solution and 10% serum. The left hemothorax is attributed to the fracture line found in the aorta. The coarctation may have arisen from localized aortitis

(1) J Thoracic Surg 26 290-299 September 1953

Arterial Grafting for the Ischemic Lower Limb is described by H. H. G Eastcott[2] (St. Mary's Hosp., London) Arterial autografts survive practically unaltered, but homografts eventually die, all that remains being extracellular fibrous material. This includes the elastica, which persists for a long time and may account for the excellent results that can be obtained with these homografts

The method employed in providing an artery bank must supply grafts which are sterile and safe to use It should be possible to store grafts indefinitely, and the grafts should be transportable Arteries should be taken under sterile conditions from suitable donors as soon as possible after death and placed in a bottle of ice cold sterile Ringer saline The graft is then quickly frozen and subsequently stored at —79 C in solid carbon dioxide For use, they are thawed quickly by pouring saline at 37 C into the bottle containing the graft.

Main artery occlusions can be caused by war wounds and their complications, civilian injuries, primary arterial thrombosis, neoplasms, primary sarcoma, secondary carcinoma and arteriosclerosis with claudication and gangrene Homografts can be used for these types of occlusion, but the patients must be carefully selected. The direct treatment of obliterative arterial disease such as arteriosclerosis includes disobliteration, which can be done in conjunction with arterial grafting and vein grafting The latter is usually unsatisfactory Symptoms of claudication and gangrene must be carefully evaluated before subjecting a patient with arteriosclerosis of a main artery of the lower limb to arterial grafting The limbs can be studied by arteriography, oscillometry, reactive hyperemia skin test, exercise tolerance test and venous occlusion plethysmography

Primary exploratory operations were performed on 23 patients with an ischemic lower limb, and a frozen arterial homograft was inserted in 13 The lateral position provides a good approach to the femoral and popliteal arteries. Anastomosis is performed, heparin being given as soon as clamps are applied The wound is not closed immediately after grafting so as to prevent extensive infiltration of the wound

(2) Ann. Roy Coll. Surgeons England 13 177 198 September 1953

by blood that oozes from the graft under the influence of heparin. A delayed primary suture is performed three to five days after surgery

In most patients with localized arteriosclerotic occlusion of the femoral or popliteal artery it is possible to restore the main vessel with an arterial homograft. Of the 18 grafts inserted, 4 were immediate failures Three of the patients had little change in symptoms and one had to have an amputation. In nine patients the grafts have remained patent as judged by return of palpable pulses, results of arteriography and relief from symptoms Two patients later had a recurrent thrombosis and one required an amputation The other six patients have maintained their excellent results

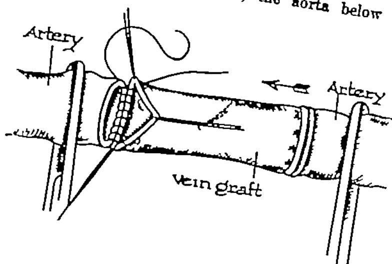
Blood Vessel Grafting Indications and Technics Paul T DeCamp[3] (Tulane Univ) has found grafts most useful for bridging long defects in major arteries. Grafts have been used successfully in congenital coarctation of the aorta, for traumatic arterial or arteriovenous aneurysms, for replacement of an indispensable blood vessel locally invaded by cancer, for aneurysmal dilatations of major arteries and, occasionally, for segmental thrombosis in primary arterial disease To relieve portal hypertension, vein grafts have been used to shunt between the portal vein and the inferior vena cava and between the stump of a previously ligated splenic vein and the left renal vein. Vein grafts have also been used between the thoracic aorta and the coronary sinus to increase the myocardial blood supply

Autogenous grafts excel homologous ones in that autogenous tissue remains viable Since few major arteries may be sacrificed selection is limited largely to the use of vein grafts. Reinforcement with fascia helps to prevent aneurysmal dilatation when major arteries need to be replaced, but in these circumstances a carefully preserved homologous graft is preferable Homologous grafts must be taken with sterile precautions from a young healthy person within eight hours of death. The entire aorta is removed, and then the adventitia is dissected free and branch vessels are ligated flush with the surface The grafts are then cut to desired

(3) S Clin. North America 32:1039-1048 August, 1952.

lengths and placed in small glass containers and can be preserved in a frozen carbon dioxide box for six months or more

Technic.—All peripheral arteries, the aorta below the renals



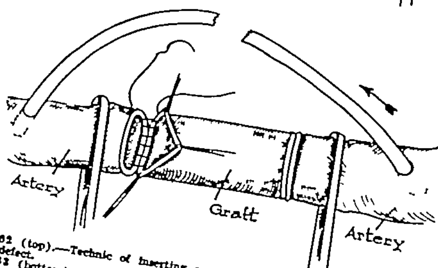


Fig 62 (top).—Technic of inserting an autogenous vein graft into a peripheral arterial defect.

Fig 63 (bottom).—Technic of grafting a homologous arterial graft with use of lateral shunt plastic tubing.

(Courtesy of DeCamp 1 T S. Clin. North America 33:1039 1048 August 1953)

and probably the carotid arteries may be safely clamped off during grafting The involved segment in congenital coarctation of the aorta may be clamped because of preformed collateral circulation. However, it is not safe to occlude the ascending arch of the aorta for more than 2 or 3 minutes, or the previously unobstructed thoracic aorta distal to the carotids for more than 15 minutes without causing spinal cord injury

A suitable vein is chosen, the adventitia removed, the branches ligated and the graft excised. The diseased segment is dissected free and noncrushing clamps are applied above and below the diseased area which is removed The ends of the graft are triangulated with traction sutures of 5-0 Deknatel silk (Fig 62) and anastomosis is done with interrupted everting sutures of the same material. The direction of the graft must be reversed so that the valves will not interfere with the flow of arterial blood Regional heparinization is advisable if blood flow through the distal arterial has been interrupted for a few hours. A dilute solution of heparin (10 mg %) is injected slowly through a small polyethylene tube inserted proximal to the graft for 48 hours. However, while the internal or common carotid is occluded it may prove safer to provide a shunt by using a lateral shunt of plastic tubing (Fig 63) Longitudinal or lateral shunting may facilitate grafting of other vital vessels.

Arterial Homografts Experimental Study in Dogs Tor Hiertonn[4] (Karolinska Inst) became interested in arterial grafts after the work of Gross *et al* in 1949 Although the need for a method to bridge gaps in major arteries has long been felt and preliminary proof that preserved arterial segments could be used as homologous vascular grafts was provided at the beginning of the century by Carrel and others, the practical clinical use of arterial homografts was not demonstrated until recently The availability of arterial segments of different calibers and lengths, preserved in a vessel bank, appears to provide new and improved possibilities of treating not only congenital deformities of the heart and major arteries, but also acute injuries to the central and peripheral arteries

It is not yet known whether cells of a viable transplant survive or die and are replaced by new cells from the host. Although the early results of arterial grafting have been good, there have been no adequate long term follow up studies When early histologic changes are considered, it is conceivable that late complications may occur

An experimental blood vessel bank was established for the preservation of aortic and peripheral arterial segments of the dog at 1-4 C in 10% homologous serum in phosphate buffered Tyrode's solution Oxygen consumption, studied by the Warburg technic, showed that most segments (80%) continued to respire for 10 days and about 40% maintained

(4) Acta orthop. scandinav supp. 10 1952

significant tissue respiration for three to four weeks

Experimental defects in the abdominal aorta (14 cases) and in the femoral artery (24 cases) were bridged with homografts of various kinds. It was technically important to use careful atraumatic technic and to have a collection of stored segments large and varied enough so that the right size of graft could be found in the bank to fit each need. It was usually possible to establish the patency of grafts by observation of the dog's general activity and by palpation of the femoral pulse The transplantation of peripheral arteries was often complicated by thrombosis, regardless of the storage period Arteriography both early and late was used to visualize the lumen. No secondary dilatation of the graft was seen If the lumen remained patent for the first few weeks after operation, it also did throughout the observation period

Arteriography under different conditions of blood pressure indicated that the graft is relatively rigid and does not conform entirely to the contractions and dilatations of the host vessel. Histopathologic study disclosed that the intima disappeared during storage or shortly after implantation In the media the muscle cells gradually died whereas the elastic structure appeared to be highly resistant. At the junction of graft and host, the collagenous connective tissue appeared so normal that it sometimes seemed that connective tissue cells from the original adventitia of the graft had survived As devitalized specimens presented the same picture, in these cases the collagenous bundles of apparently normal connective tissue visible between the elastic lamellae of the graft must have arisen from the host There is precipitation of fibrin in the region of the original intima, fibroblasts grow in beginning at the sites of the anastomoses, and collagenous and elastic fibers are eventually formed The surface cells tend to flatten and to resemble endothelium. After a year the fibrocellular layers, or the "new intima," has become a thick membrane

In general there was no great histologic difference between respiring and nonrespiring homografts except that the latter showed occasional thrombi, areas of myxomatous degeneration calcium deposits and breaks in the lamina elastica in

terna. Devitalized vascular segments would therefore seem somewhat less satisfactory It was, however, impossible to relate exactly the method of preservation or the storage time to the process of healing or to the final functional result. It should be noted, however, that all peripheral transplants treated with KCN or C_2H_5OH became thrombosed.

The tensile strength of the anastomoses compared favorably with that of the intact host aorta. The grafts themselves had considerable tensile strength. The risk of aneurysmal dilatation or rupture in the area of transplantation would therefore seem to be small.

[This is an excellent study which can be recommended to anybody who is contemplating any experimental work on this subject.—Ed.]

Experimental Vascular Grafts III. Dimensional Changes in Short and Long Length Fresh and Preserved Aortic Homografts Implanted into Thoracic Aorta of Growing Pigs, Preliminary Report Lloyd N Nyhus, Edmund A. Kanar Horace G Moore, Jr, Everett J Schmitz, Lester R. Sauvage and Henry N Harkins[5] (Univ of Washington) implanted aortic homografts into the thoracic aorta in nine weanling pigs weighing an average of 12 4 kg Absorbable and nonabsorbable sutures were used and anastomosis was performed with either continuous everting mattress or continuous Carrel suture The pigs were allowed to grow to maturity until the average weight was 109 kg Two pigs died of complications unrelated to the graft. The other animals were killed and the homografts examined No thrombosis, rupture or dilatation of grafts was found, and all grafts were patent A comparison of the growth of the grafts with that of the rest of the aorta showed growth in the short and long fresh and preserved thoracic aortic homografts, but the rate was slower than that of the host aorta. Growth of the thoracic aortic homografts tended to lag behind that of the host aorta no matter how long the homografts had been preserved.

Recognition and Treatment of Arteriosclerotic Stenosis of Major Arteries. Edwin J Wylie and Joseph S McGuinness[6] (Univ of California) have studied the clinical and pathologic characteristics of proved stenosis of major ar

(5) Surg., Gynec. & Obst. 97 81 86 July 1953
(6) Ibid., pp. 425-433 October 1953

teries due to arteriosclerosis in four categories of patients 12 with segmental arteriosclerotic narrowing as the sole demonstrable cause for complaints of arterial insufficiency, 6 with asymptomatic arterial stenosis as an incidental arteriographic finding, 6 whose stenotic lesion progressed to complete thrombosis, and 3 with a significant stenotic lesion



Fig 64 —Drawings from aortograms of 12 patients with stenotic lesions limited to a short segment of a major artery All but one patient (bottom row second from left) complained of incapacitating muscular pain or fatigue on walking (Courtesy of Wylie E. J., and McGuinness, J S.: Surg Gynec & Obst 97 425-433 October 1953)

apart from a separate zone of arterial thrombosis All but two were men, and in all the pathologic changes involved the major arterial tree between the upper abdominal aorta and the level of bifurcation of the popliteal arteries The diseased intima was resected in 12 patients.

For more thorough visualization by aortography, 50 cc contrast medium was injected rapidly into the abdominal aorta proximal to the celiac axis (Fig 64) The pathologic

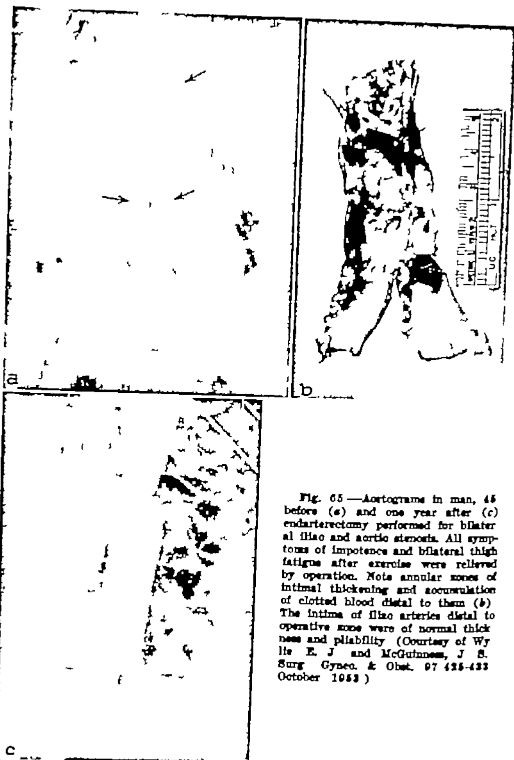


Fig. 65—Aortograms in man, 45 before (*a*) and one year after (*c*) endarterectomy performed for bilateral iliac and aortic stenosis. All symptoms of impotence and bilateral thigh fatigue after exercise were relieved by operation. Note annular zones of intimal thickening and accumulation of clotted blood distal to them (*b*) The intima of iliac arteries distal to operative zone were of normal thickness and pliability (Courtesy of Wylie E. J and McGuinness, J S. Surg Gynec. & Obst. 97 425-433 October 1953)

and arteriographic characteristics of the lesions encountered proved to be closely related Significant changes, never observed proximal to the level of the superior mesenteric artery, were noted in most cases only distal to the renal arteries The most pronounced stenosis was usually noted near the orifice of a major arterial branch Also, at a zone of stenosis, variable portions of the circumference were thickened, some with an annular "napkin ring" lesion.

Arterial stenosis sufficient to cause symptoms is a lesion predisposing to the development of arterial thrombosis Partially organized, clotted blood was often adherent to the luminal surface of the intima at the level of stenosis (Fig 65, *a-c*) The observations suggest that (1) stenosis due to extraluminal thickening of the arterial wall represents an intermediary stage in the development of thrombosis, (2) local accumulation of intraluminal clotted blood is the factor precipitating complete occlusion, and (3) collateral flow tends to limit levels of proximal and distal extension of the subsequent intraluminal thrombus to major arterial branches

The surgical specimen of the resected thickened intima is a hollow inelastic cylinder Measurements have suggested that the lumen of a major artery must be reduced by at least 90% to impair blood flow enough for ischemic symptoms distal to the level of stenosis

In patients with a single stenotic segment or complete occlusion the symptoms and signs could be referred to a specific level and degree of arterial obstruction. Stenosis of the superficial femoral artery caused calf claudication and chronic coldness of the foot Common femoral stenosis caused severe fatigue of posterior thigh muscles on walking Unilateral stenosis of the common iliac artery caused gluteal and femoral fatigue and often a deep aching pain in the hip, produced by walking and relieved by rest, bilateral stenosis produced the same symptoms on both sides and also sexual impotence

Endarterectomy and bilateral lumbar sympathectomy were performed in patients with aortic or iliac lesions, with good results in 10 Symptoms which prevented normal activity constituted the indication for operation

Future of Surgery in Senile Obliterative Arterial Disease Charles Rob[7] (St. Mary's Hosp., London) stresses that although senile obliterative arterial disease is a disease of the entire arterial system, one region may be affected more than others and it is against these local manifestations that the surgeon's efforts can be directed The local manifestations may be apparent in the blood vessels of the lower limbs, the coronary arteries, the cerebrovascular system, or they may involve an aneurysm of the aorta. Anatomic study of the changes in the arteries in arteriosclerosis has shown that local manifestations are produced in a high proportion of patients by a relatively short thrombosis in a main vessel. This knowledge has changed the surgeon's approach to these diseases

In the past, the approach to treatment of the symptoms of senile obliterative arterial disease has been indirect and has consisted of sympathectomy, creation of an arteriovenous fistula, ligation of the main vein in an attempt to increase the oxygen supply to the tissues by producing venous congestion, relief from pain due to ischemia by interruption of afferent nerve pathways or placing the ischemic muscle at rest by interruption of motor nerve supply or division of the tendon

In disease of the coronary artery, attempts have been made to increase the blood supply to the myocardium by producing adhesions between the heart and the pectoralis major muscle, the heart and the great omentum and the heart and the pericardium Other methods include ligation of the great cardiac vein, arteriovenous anastomosis between the coronary sinus and an artery, implantations of the internal mammary artery into the myocardium and various procedures designed when necessary to decrease the activity of the heart (thyroidectomy) or to relieve cardiac pain.

The direct approach to local manifestations of senile obliterative arterial disease is now a practical possibility An occluded segment of the large or medium-sized artery can now be replaced by an autologous vein graft or a homologous artery graft Various hospitals throughout the world have had satisfactory results with these operations and

(7) Brit. M. J 2 208 210 Aug. 8 1953

their scope may, in the future, be extended to the coronary and intracranial arteries and the aorta. Grafting of coronary arteries should soon be possible as animal experiments have proved the feasibility of grafting either veins or arteries in disease of the coronary arteries

[This type of operation of course has already been used in the repair of arteriosclerotic aneurysms of the aorta. See the article by Cooley and De Bakey on page 205.—Ed.]

Importance of Collateral Circulation in Obliterative Arterial Disease of Lower Extremities is discussed by Louis G Herrmann, John J Cranley and Rosamunde M. Preuninger[8] (Univ of Cincinnati) Many middle-aged and elderly patients have viable extremities despite absence of palpable pulsations distal to the femoral artery or beyond the aortic bifurcation. Little can be done at present for arterial obliteration in arteriosclerosis obliterans, but even complete occlusion of major arteries does not always result in ischemic necrosis Therefore, adequacy of the over all arterial circulation depends on the ability of the collateral arteries to assume a sufficient part of the nutritive load to supply the tissues of the feet A limb with major arterial obliteration and fully developed collateral circulation is usually safe from ischemic necrosis. Except for a few cases of localized obstruction amenable to excision and grafting, primary therapeutic emphasis should be on enhancement of the collateral arterial circulation

The natural process of maintaining adequate arterial circulation can be helped by reducing the requirements of the limb for blood and eliminating the factors that reduce effective circulation by avoidance of local heat, infection, cold, overactivity and tobacco Though the exact stimulus for improving collateral circulation is not understood, the proximate mechanisms are governed by laws of motion of all enclosed fluids, i e., head of pressure, peripheral resistance and viscosity To date, change of the viscosity and pressure of the blood without increase of the peripheral resistance is not feasible Decrease in peripheral resistance has been attempted through passive vascular exercises within a boot and by producing vasodilatation by physiologic stimuli, chemical means, block of sympathetic ganglions or

(8) Geriatrics 9 1 7 January 1954

In 18 previously reported patients, 8-38 cm. of the obstructed femoral artery was resected and replaced with venous graft 19 times, 16 were autogenous grafts taken from the saphenous or the superficial vein of the same extremity, and 3 were homologous grafts taken from another person by ligation and saphenous stripping performed on the same day Ten grafts were placed in 9 patients followed for 6-20 months, in each, the symptoms were relieved and palpable peripheral pulses proved the patency of the graft. Two of the three homologous grafts remained patent. Of seven autogenous and three homologous vein grafts attempted in 10 additional patients, four were successful, among them, the three homologous grafts

The principal causes of failure are failure to use anti coagulants and hematomas arising as a complication of heparin therapy Another cause has been poor selection patients with extensive arterial disease seldom have good results.

After segmental resection of the aortic bifurcation homol ogous grafts were inserted in three patients, aged 39-56, with the Leriche syndrome—intermittent claudication and lack of both femoral pulsations and of significant ischemic changes in the distal parts of the extremities. As a result, one patient became asymptomatic and had bilateral ankle pulses, whereas the other two had calf claudication, and no ankle pulses in one leg, with palpable ankle pulses in the other

Primary Repair of Major Arterial Injuries Report of 58 Battle Casualties Edward J Jahnke, Jr, and John M. Howard[2] (M.C., U.S.A.) assess the feasibility and value of primary repair of arterial wounds at the time of initial definitive treatment at Army forward field hospitals from April to September, 1952. The lapse of time from injury to treatment in all cases averaged 8 3 hours. After control of the hemorrhage, the primary wound in all patients was explored and the defect in the arterial tree located. Both proximal and distal ends of the severed artery were debrided. The artery was freed proximally and distally to permit approximation without tension, collateral circulation was sacri

(2) A.M.A. Arch. Surg. 66 646-649 May 1953

ficed, as required to attain this goal. The adventitia was then stripped away from the cut ends of the vessel to facilitate suture. Anastomosis with continuous everting mattress suture of 5-0 braided nonabsorbable surgical silk was then performed. When direct end-to-end anastomosis could not be achieved without undue tension, an autogenous vein graft was inserted. In five cases, arterial spasm in the proximal segment of the severed artery responded when a sponge soaked in 2.5% papaverine hydrochloride solution was wrapped around the vessel. After completion of the vascular repair, devitalized muscle was excised and all other wounds debrided. The skin and subcutaneous tissues were always left open. The extremity was immobilized in a split cast immediately after operation.

Only six patients (10.3%) later required amputation of the involved limb as against a 49% amputation rate during World War II when ligation was the prevailing method of treatment. Failures were due either to irreversible preoperative damage in tissues of the extremity from ischemia or to errors in operative technic. Four of six failures resulted from anastomosis or vein graft performed eight or more hours after injury. Errors in operative technic involved primarily tension at the site of anastomosis and, almost equally, inadequate debridement of the artery and surrounding tissue. In three instances, there was thrombosis at the suture line. Accordingly, time lag and thrombosis were the primary hazards of repair and infection was of relatively minor significance. Although the percentage of success with anastomosis decreased after eight hours, the success of an individual anastomosis could not be predicted on the basis of time lag alone. Further study to delineate the limits of this mode of therapy is essential.

Ligation of Hepatic and Splenic Arteries in Treatment of Cirrhosis with Ascites was done by William Francis Rienhoff, Jr., and Alan C. Woods, Jr.[3] (Johns Hopkins Univ.) in 23 patients who had ascites and hemorrhage from esophageal varices as a result of cirrhosis. None had responded to medical therapy. After preliminary preparation with antibiotics the common hepatic artery was ligated

(3) J.A.M.A. 152:687-690, June 20, 1953.

at the level of the foramen of Winslow distal to the departure of the gastroduodenal artery, and the splenic arteries were ligated in the lesser peritoneal cavity along the superior margin of the pancreas

Over all mortality was 30 4% Six patients died immediately after operation and one died three months later Two deaths were due to esophageal hemorrhage, one to cardiac failure and pneumonia, two to progressive liver failure, one to uremia and one to reasons unknown. There were two diagnostic errors In one patient found to have extensive carcinomatous metastases in the liver from an esophageal lesion the ascites was relieved, in another who had multiple hemangiomas of the liver, the ascites improved after surgery

All 15 survivors improved after surgery, especially those with cirrhosis with ascites. The mortality rate was higher in those who bled severely before surgery Comparison of results of pre and postoperative liver function studies showed no common pattern of change in these patients There was an occasional increase in jaundice and serum bilirubin values The most significant changes were an increase in total serum protein values and return to near normal of the albumin globulin ratio in several instances, probably reflecting the decrease in ascites and waste of protein in ascitic fluid.

The study shows that the greatest benefit from ligation of the common hepatic and splenic arteries is in patients with intractable ascites alone The operation reduces the chronic passive congestion of the liver, but is probably not good for those with hemorrhage from esophageal varices alone There were no instances of gross liver necrosis in the series, probably because of the preoperative antibiotic preparation of the patients

Mesenteric Vascular Occlusion Report of Five Successful Resections Walter L Mersheimer James M Winfield and Russell L Fankhauser[4] (New York Med. College) include in the syndrome (1) thrombosis of mesenteric veins, (2) embolism or thrombosis of mesenteric arteries, (3) rupture of mesenteric vessels, and (4) traumatic injuries to mesen

(4) A.M.A. Arch. Surg 66 752 768 June 1953

teric vessels. It is not always possible to determine whether the infarction is primarily arterial or venous, and if arterial whether embolic or thrombotic. Venous thrombosis is commoner than arterial occlusion and arterial thrombosis commoner than arterial embolus A combination may occur Inciting factors of secondary mesenteric venous thrombosis are (1) mechanical obstruction of the portal flow, (2) intra abdominal infection or, less commonly, peripheral sepsis, and (3) blood dyscrasias Arterial emboli originate from the left atrium, particularly when fibrillation is present from the aortic or mitral valve, when there is active endocarditis or mitral stenosis, and from atheromatous plaques in the aorta. Mesenteric arterial thrombosis occurs in generalized arteriosclerosis, atheroma, aneurysm of the aorta or mesenteric artery, thromboangiitis obliterans, periarteritis nodosa and Raynaud's disease

There is no definite composite symptom complex of this deceptive disease, and it often pursues an atypical course Correct diagnosis is difficult it is more important to be cognizant of a surgical emergency The dominant features are excruciating pain, usually constant not relieved by narcotics. Vomiting is copious. Involuntary spasm is present throughout the abdomen but rigidity is never proportionate to degree of pain As infarction progresses, temperature rises, pulse rate increases and blood pressure falls Leukocyte count is usually elevated X rays are not of significant diagnostic value frequently showing slight distention in both small and large intestine An over-all haziness or ground glass appearance may suggest serosanguineous intraperitoneal fluid Whenever a strangulating type of intestinal obstruction is suspected immediate abdominal paracentesis is indicated Presence of serosanguineous fluid demands prompt surgical exploration

Radical resection and restoration of continuity of the intestine by primary anastomosis is the treatment of choice Resection of 65% of the small intestine is safe and the remaining intestine will carry the increased load efficiently If the postoperative course suggests extension of the occlusive process, a second operation is indicated

Operative Technic for Construction of Venous Valves to combat valvular incompetence in the postphlebitic syndrome is described by Ben Eiseman and William Malette[5] (Washington Univ)

TECHNIC.—In dogs under intravenous sodium pentobarbital anesthesia, the inferior vena cava is exposed and mobilized from the iliac

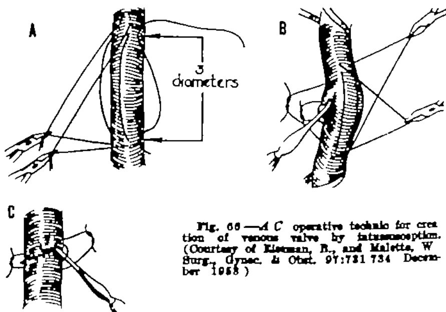


Fig. 66.—*A*-*C*, operative technic for creation of venous valve by intussusception. (Courtesy of Eiseman, B., and Malette, W.: Surg., Gynec. & Obst. 97:731-734, December, 1953.)

bifurcation to the renal veins. Proximal intussusception is accomplished by placing five or more 5-0 arterial sutures along the longitudinal axis of the vein with the second bite of the sutures placed 3 diameters proximal to the first (Fig 66, *A*) Each suture is taken through the entire vein wall. Intussusception is achieved by a combination of gentle traction on the sutures and by proximal guidance of the point of the intussusception into the lumen of the vein with a dull probe (Figs. 66 and 67) Sutures are tied and the valve tested by occluding the distal segment of vein and milking blood through the valve, leaving the lumen distal to the valve empty of blood. Reflux should not occur through a competent venous valve. Anticoagulants were not used.

Valves so constructed in 14 dogs were examined 24 hours

(5) Surg., Gynec. & Obst. 97:731-734, December, 1953.

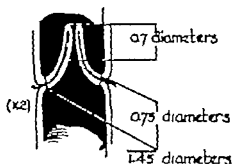


Fig. 67.—Cross-section of completed valve showing dimensions used. (Courtesy of Eiseman, B., and Malette, W. Surg., Gynec. & Obst. 97:731-734, December 1953.)

Fig. 68.—Venograms of dog four months after creation of valve in midportion of abdominal vena cava: left, patency of valve; right, competency of valve. (Courtesy of Eiseman, B. and Malette, W. Surg., Gynec. & Obst. 97:731-734, December 1953.)

to 6 months following operation Thrombosis did not occur at the operative site, and the intussuscepted vein showed no tendency to contraction or fibrous degeneration. Venographic proof of valve patency and constancy was obtained by injection of 70% urokon* into the femoral and right renal veins, compressing the vena cava proximally (Fig 68)

Use of the technic clinically requires that the short segment used for the valve be essentially normal.

Thrombophlebitis and Phlebothrombosis Alton Ochsner[6] (Tulane Univ) states that in venous thrombosis distinction must be made between clots associated with inflammatory process of the veins (thrombophlebitis) and those without antecedent or associated inflammatory lesion (phlebothrombosis) Venous thrombosis is common, occurring about once in every 500 general hospital admissions. In Charity Hospital, New Orleans, expected incidence of postoperative fatal emboli is 1 in 878 operations Expected incidence of non operative fatal emboli is 1 in every 502 patients The incidence of venous thrombosis has increased progressively from 1938 to 1950, although that of fatal embolism has not increased as rapidly Of all the cases of thromboembolism, 34% occurred on the surgical service, only 23% of the fatal emboli were on this service The respective incidences on the medical service were 32% and 55% The higher incidence of fatal complications on the medical service is due to higher incidence of phlebothrombosis in medical cases as contrasted with higher incidence of thrombophlebitis in surgical cases Heart disease was the commonest disease associated with fatal pulmonary embolism Of 1,223 patients with thromboembolism, 40% died, mortality rate was 67% on the medical service and 26% on the surgical service

In thrombophlebitis the vein wall is inflamed, and the clot which is secondary to changes in vascular endothelium *is firmly attached to the vein wall The inflammation is* usually secondary to perivenous lymphangitis in which either organisms or toxins are carried through the lymphatics to the vascular endothelium The patient has pain, usually due to arteriolar spasm, the leg is swollen, the skin is frequently white and there may be pyrexia. Prognosis

(6) M Clin North America 37:1113 1118 July 1953

as regards life is good because the clot is fixed. Symptoms are due to vasospasm of homolateral vessels and can be relieved by sympathetic block, which may have to be repeated daily. Compression bandages, ambulation and active movement relieve edema. Symptoms usually subside in 7-10 days if these measures are used. Persistent edema, varicosities, ulceration, recurrent erysipeloid infections and elephantiasis may follow if the condition is neglected. Interruption of the vein on the cardiac side of the thrombophlebitic process is imperative only in suppurative thrombophlebitis.

In phlebothrombosis the clot occurs because of changes in the blood which favor clotting and slowing of the blood flow. Trauma of operation, accident or invasion of tissue by neoplasm or infection, anemia and blood dyscrasias may cause the clotting defect. Phlebothrombosis usually occurs in the veins of the legs where blood flow is slow, especially in bedridden patients. Ambulation or active contraction of muscles against resistance, avoidance of chilling and compression bandages are prophylactic measures against phlebothrombosis. Although anticoagulants can prevent clotting their routine administration probably would be more harmful than the danger of phlebothrombosis.

Diagnosis of phlebothrombosis is difficult. Tenderness over the veins, Homan's sign, elevation of temperature and apprehension are suggestive. In only 60% of patients with fatal pulmonary embolism secondary to phlebothrombosis was there clinical evidence of the antecedent thrombus before the fatal episode. The only treatment is interruption of the venous channel on the cardiac side of the clot. It may be necessary to interrupt the femoral veins, iliac veins or inferior vena cava.

Place of Venous Shunts in Treatment of Portal Hypertension. From his experience R. Milnes Walker[7] (United Bristol Hosp.) has reached these conclusions: (1) Portal-systemic shunt is indicated to prevent hemorrhage from gastric and esophageal varices but not in direct treatment of ascites. (2) Ascites associated with hepatic fibrosis is due not to raised portal venous pressure but to severe liver

(7) Ann. Roy. Coll. Surgeons England 14:145-157, March, 1954.

damage (3) The liver remains normal in cases of extra hepatic obstruction. (4) Satisfactory venous shunts must be large, only the portal and splenic veins are adequate. (5) The portal vein is best for anastomosis, unless thrombosed. (6) Right thoracoabdominal incision is preferred. (7) If shunt is not feasible, direct operation on the varices should be performed.

End to-side portal vein inferior vena cava anastomosis is preferable to side-to-side because it provides an opening as wide as the portal vein, avoids the possibility of thrombosis from the stagnant intrahepatic portion occluding the anastomosis and causes less distortion of the portal vein.

Extrahepatic hypertension is probably congenital in origin, a true venous angioma or stricture The only symptom, hemorrhage, begins as early as age 3 and always before 18 Splenectomy is of no value and removes the possibility of splenorenal anastomosis In the intrahepatic type the degree of obstruction bears no relation to the amount of fibrosis. As the factors controlling portal blood flow are not known, portal venography by intrasplenic injection is the only means of determining before laparotomy which veins of the portal system are available for anastomosis

Since a standardized method had not been devised before 1950 only 4 of 15 patients operated on remained well without further operation. End to-side portacaval anastomosis, true Eck fistula, is now considered the operation of choice, but it is only feasible in cases of intrahepatic obstruction

Girl, 18, hospitalized because of severe hematemesis, had enlarged spleen. Esophageal varices were revealed by barium swallow and esophagoscopy Results of liver function tests were within normal limits. At operation the liver was firm with slightly raised coarse nodules and enlarged surface veins. Portal venous pressure was 440 mm. water, falling to 270 mm. after end to-side portacaval anastomosis. The spleen was hardly palpable and she was well 20 months after operation.

Most cases conform to this pattern, but a history of acute hepatitis is obtained in a few The spleen is enlarged and occasionally there are signs of hypersplenism with bruising, bleeding from nose and gums, leukopenia and thrombocytopenia Liver function tests give variable results Jaundice and albumin levels below 3 gm./100 ml. or lower than the

globulin level are specific contraindications to operation.

In 23 of 30 operations since 1950 (20 end to-side porta caval, 2 end to-side splenorenal anastomoses and 1 side-to-side splenorenal anastomoses, there was no further bleeding after operation.

Venous Thrombosis, Necrosis and Neoplasia. Charles A. Hubay and William D Holden[8] (Univ Hosp., Cleveland) recommend that a diligent examination of all viscera be made when a patient is seen with venous thrombosis of undetermined origin. In the past few years they have seen eight patients with symptoms and signs of peripheral venous thrombosis or pulmonary emboli or both, seven of whom had occult neoplastic lesions and one tuberculosis.

Case 1.—Woman, 27, had a history of fatigability, palpitations, dizziness and exertional dyspnea for seven months. Four months before admission, when seen by a physician because of calf pain phlebitis and anemia were diagnosed. Two weeks before admission she noted pain on walking and daily fever developed. Redness, swelling and pain in the right antecubital fossa and paresthesias of all extremities developed one week before admission. There was weight loss of 27 lb in six months. The liver was palpable 2 fingerbreadths below the right costal margin, and a questionable mass was present in the right lower quadrant. There was a 6 in. thrombus in the right antecubital vein, and a positive Homans sign was elicited bilaterally Hemoglobin concentration was 8 Gm., red cell count 3,480,000 and prothrombin level 63.5% The stool was positive to the guaiac test. A barium enema showed a constricting lesion in the right colon Laparotomy revealed a nonobstructing lesion in the ascending colon and extensive liver infiltration by a malignant tumor Liver biopsy showed a partially differentiated mucinous adenocarcinoma. No further surgery was done.

Case 4.—Man, 42, about six weeks before admission and shortly after a respiratory infection, noted a dull aching in the right heel Two weeks later a cough developed, which became productive of sputum mixed with blood for four days before admission. Two weeks before admission pain developed along the costal margins, referred to both shoulders. X rays showed a recent pneumonic infarct at the left base. Pain and tenderness along the left brachial vein and slight calf tenderness developed. Heparin and dicumarol[9] therapy were started. A large pulmonary infarct appeared, and the patient was in extremis three weeks after admission. Biopsy of two subcutaneous nodes in the lower left side of the neck revealed anaplastic carcinoma simplex. Autopsy showed anaplastic adenocarcinoma of the lung arising in the posterior branch of the left lower

(8) Surg., Gynec. & Obst. 98 209-217 March, 1954

lobe with numerous necrotic metastases and generalized thrombophlebitis.

The mechanism for production of thrombosis remains obscure The common denominator may be the presence of necrotizing tissue of either inflammatory or neoplastic nature

It is not felt that the patient is always doomed once thrombophlebitis is detected, and neoplasms should be treated as usual in an effort to obtain cure In many, the underlying disease may be nonmalignant.

[As the authors state in their original article, ever since the classic article by Sproul in 1938 it has been known that carcinoma of the body or tail of the pancreas is particularly likely to be associated with multiple venous thrombosis.—Ed.]

Functional Venography of Lower Extremities Harris B Shumacker, Jr., Thomas C Moore and J A. Campbell[9] (Indiana Univ) report on 115 venographic studies done before and after exercise of the dependent limb These include studies on 23 normal subjects

In 10 normal subjects placed supine on an x ray table tilted 60 degrees, 30 cc of 35% diodrast* or 50% neo-iopax* was injected slowly into the common femoral vein through a no 18 needle introduced percutaneously Exposures were made immediately after injection and after about one minute of vigorous exercise Opacification of the common femoral vein only down to the first or second valve was evident in the first films of three subjects Significant regurgitation was observed in seven In all, after exercise, the superficial and profunda femoral veins were completely or almost completely emptied of radiopaque material. This procedure was repeated in 10 other normal subjects, except that the patients were prone and the injection carried out in the popliteal space In all, a varying amount of regurgitation into the deep veins of the leg was noted at first, with clearing on exercise Percutaneous injection into the superficial veins about the knee or foot was performed on the other three normal subjects Both superficial and deep systems were visualized, with clearing on exercise

Ninety two functional venographic studies were done on patients with suggestive evidence of venous stasis or lym

(9) Surg Gynec. & Obst. 98:257 272 March, 1954

phatic blockage In most, injection was made at only one site In patients with varicose veins, when injection was made into a superficial varix there was no evidence of proximal return in the superficial venous system before or after exercise With popliteal injection, regurgitation into the varices often occurred The deep venous system cleared after exercise Popliteal and a few femoral vein injections were done on patients with deep venous alteration after thrombotic occlusion or ligation Various degrees of re canalization occurred, and no valves could be demonstrated On exercise, the recanalized veins cleared, and all were able to participate in proximal propulsion of blood, though per haps not as effectively as in normal subjects No apparent regurgitation down the recanalized veins was observed. In patients with edema and no demonstrable venous pathologic involvement, venographic studies revealed normal veins

From the results obtained popliteal injection appears to be the most and femoral injection the least useful. Func tional evaluation by venography necessitates use of both dependency and exercise Although neo iopax® was used in most of the patients studied, recent experience indicates that urokon® may prove a more desirable radiopaque solu tion.

The authors believe, contrary to generally held opinions that as the recanalized vein does contribute to proximal propulsion of blood toward the heart there is no indication for ligating it Since regurgitation down the femoral vein occurs in a high percentage of both normal and abnormal subjects and clears with exercise, regurgitation in quiet dependency is not an indication for interruption of either femoral or popliteal veins

Postoperative Intravascular Thrombosis Harold Dew[1] (Univ of Sydney) observes that stasis in the circulation un doubtedly is one of the major factors of intravascular clot ting Small clots are probably common and removed by the normal circulation. There must be in addition some abnor mality of the blood itself before clotting can take place

Most authorities believe that clotting in the pulmonary arteries is nearly always secondary to intravascular throm

(1) Ann. Roy Coll. Surgeons England 13 1 16 July 1953

bosis elsewhere and that this phenomenon, at least at its inception, is predominantly embolic The author believes that intravascular thrombosis not only can occur in the lungs as a primary phenomenon but is much more common than is usually thought Since all factors necessary for intravascular clotting are general phenomena, clotting can occur anywhere Even advocates of the concept of secondary pulmonary embolus who regard a primary condition as being present in the legs in 90%, leave unexplained the other 10%

Most lesions occur in the lower lobes of the lungs, probably because the embolus is carried there by the strongest current It is equally true that circulatory stasis would show itself more obviously in the larger vessels at the bases.

Onset of massive clotting is not as sudden as usually is taught. However, once a clotting phenomenon has been initiated, if the coagulability of the blood is high, it may proceed at great speed so that a massive primary thrombosis can be almost as dramatic clinically as a large embolism.

The author does not practice ligature of peripheral veins because the operation is based on misunderstanding of the pathology of the disease and must be valueless in treating a general blood abnormality The good effects produced by ambulation and the controlling effect of heparin support this belief.

When fibrinogen B in the plasma is associated with a lowered coagulation time and a suggestive temperature chart, intravascular thrombosis either in the lung or in the lower limb is practically inevitable Prophylaxis through active movement ambulation, deep breathing and heparin, if lowered coagulation times and tests for fibrinogen B indicate, may prevent many of these cases Treatment should include heparin and dicumarol[3] plus active movement.

Practical Uses of Venography According to F B Cockett[2] (St Thomas's Hosp., London) venography is most helpful in the diagnosis of incompetence of the deep and the communicating veins of the legs Deep venous incompetence is difficult to localize or assess clinically The valves in the deep veins are destroyed by thrombosis. In the acute stage

(2) Brit. J Radiol. 26 339 345 July 1953

deep thrombosis may be confined to the calf or occur as a white leg or deep femoral thrombosis—a sudden, painful swelling of the leg after severe illness, major surgery or parturition In deep femoral thrombosis the whole leg, from toes to groin, suddenly swells, grows painful and hot and the superficial veins become distended. A venogram in the acute phase will show involvement of the femoral vein in segmental thrombosis or thrombosis in continuity with all deep veins of the leg After a month or two the acute edema and tenseness in the leg subside as adequate venous collateral circulation is established

A triad of symptoms usually occurs within two to three months (1) heavy aching pain, particularly toward the end of the day in the calf and lower leg, (2) swelling of ankle and leg, and (3) ulceration of the ankle just above and behind the internal malleolus These symptoms arise from recanalization of the thrombosed deep veins which have no valves The Valsalva technic of venography has done much to reveal these incompetent deep channels, which are best treated by ligation of the incompetent deep channels in Hunter's canal just above the vena profunda allowing good deep collateral venous return by way of the profunda system.

Normal flow of blood in the communicating veins is from the superficial to the deep veins of the extremity The valves prevent reflux of blood from the deep to the superficial veins If these valves become incompetent or are destroyed, the group of superficial veins drained by that communicator and the communicator itself become dilated and varicosed. In the lower part of the leg, behind the internal malleolus, the ulcer bearing area, there are three constant communicating veins that go from the superficial tissues to the deep veins Incompetence of these veins causes ulcers on the leg Venography helps to demonstrate incompetence in these communicating veins The ankle veins can be shown by the injection of contrast medium into a small vein on the dorsum of the foot with the patient erect The plate is exposed about a half minute after the injection. This rapidly floods the whole venous tree round the ankle, superficial and deep and the contrast medium is held there by gravity

Prevention and Treatment of Postoperative Thrombophlebitis Alton Ochsner[3] comments on the increase in the incidence of venous thrombosis despite conscientious use of all *known measures to prevent its development* At the Charity Hospital, New Orleans, the incidence of fatal pulmonary embolism in 1938-50 was 1 in every 878 patients operated on and 1 in every 502 not operated on

There are two types of venous thrombosis. The first, thrombophlebitis, is an inflammatory lesion that affects the vein wall with associated venous thrombosis, the thrombus results from operation in the venous endothelium and resembles that seen after the injection of a sclerosing agent into a varicose vein. Because of the inflammatory nature of the reaction of the venous endothelium, the clot (white thrombus) which forms is firmly attached to the vein wall and there is little or no danger of its detachment. If it does become detached, it produces only mild infarction. The clot can become detached in the relatively rare case of suppurative thrombophlebitis The inflammatory reaction of the vein wall is usually caused either by toxins or bacteria transported to the vein through the perivenous lymphatic system.

In phlebothrombosis—the second type—the venous clot is of the coagulation variety, similar to or identical with the clot seen in a test tube when blood is withdrawn from the body, it is only loosely attached to the vein wall and readily becomes detached. This red clot results from tissue injury which causes changes in blood constituents which favor the development of thrombosis Trauma to the tissue may be accidental, surgical or the result of neoplastic or infectious invasion This clot usually occurs in the veins of the legs and results in circulatory stasis A predisposing factor is obesity

Thrombophlebitis is not difficult to diagnose The patient complains of a swollen, painful leg with whitish discoloration Phlebothrombosis may produce few or no manifestations *In less than half of those who died of pulmonary* embolism was there demonstrable clinical evidence of a thrombus before the fatal episode Tenderness in the veins

(3) S. Clin. North America 33 993 1001 August 1953

of the calf and plantar aspects of the foot, pain on forceful dorsiflexion of the foot and along the deep veins of the thigh and increased pulse rate are indications of thrombosis

Among helpful prophylactic measures are the use of alpha tocopherol and calcium in patients undergoing severe surgical trauma early postoperative ambulation, forceful flexion of the foot against resistance while the patient is in bed, compression bandages from toes to groin, the prevention of ileus and deep breathing The routine use of such anticoagulants as heparin and dicumarol[3] in all patients in whom venous thrombosis threatens is far more hazardous than is the risk that venous thrombosis will develop

Nonsuppurative thrombophlebitis is treated by producing vasodilatation with procaine block of regional sympathetic ganglions Unless thrombophlebitis is treated, disabling postphlebitic sequelae result Phlebothrombosis is treated by immediate emergency interruption of the venous channel between the clot and the heart by venous ligation on the cardiac side of the thrombus or by thrombectomy Unless this is done nonfatal pulmonary infarction with consequent pneumonitis or massive fatal embolism can result In suppurative thrombophlebitis the vein should be ligated proximal to the site of the suppuration.

Major Venous Ligation in Treatment of Postphlebitic Sequelae A M Boyd, B N Catchpole, R. P Jepson and S S Rose[4] (Univ of Manchester) report studies on 36 women and 6 men, followed at least three years, who had major vein interruption for deep venous incompetence following thrombophlebitis Principal complaints were swelling pain and ulceration, the last the most disabling of the postphlebitic symptoms

Following treatment by bed rest, elevation, moist and occlusive dressings with streptomycin (1 100), the ulcer bed with its feeder veins could be widely excised, and the bed grafted with split skin at the time of the major vein ligation Ligation and division of the superficial femoral vein was performed just distal to the profunda femoris in 15 patients At the level of the knee it is common to find two or three separate deep venous channels It is only at the

(4) Lancet 2 113 115 July 18 1953

level of the adductor opening that a single common popliteal vein is usual. Ligation here was performed in 15 patients. In three patients popliteal and superficial femoral ligation were combined, in four the femoral ligation was combined with an ipsilateral lumbar sympathectomy, in three a popliteal ligation was combined with an ipsilateral lumbar sympathectomy, and in two a lumbar sympathectomy was combined with a ligation of the superficial femoral and popliteal veins

Of the patients followed, 40 had preoperative pain, 30 had chronic ulceration and 40 had some degree of edema. Results were good in 14, poor in 8 and 20 remained unchanged. Femoral ligation is the most satisfactory procedure

By means of a phlebographic technic in which the film is exposed immediately after the Valsalva maneuver, competent valves were demonstrated in superficial and deep veins of the legs in normal patients but not in incompetent collateral veins developing at the site of major venous ligation. Within months of division of a recanalized postphlebitic vein incompetent valveless collaterals, of a total caliber at least equal to that of the original vein, were seen coursing around the level of ligation. In none of the 29 patients tested were postoperative exercise venous pressure recordings lower than before operation and in some they were higher. It seems unlikely that interruption of the recanalized vein improved the hemodynamic efficiency of the limb. The authors believe the operation is based on a wrong conception of the hydrodynamics of the postphlebitic limb

In patients who improved, ligation of the superficial incompetent varicosities, healing and grafting of ulcers, correction of general nutrition and detailed education of the patient in limb care and hygiene are the factors most concerned in amelioration. Major vein ligation in the treatment of the postphlebitic syndrome is neither empirically nor theoretically satisfactory

[There cannot be any misunderstanding of the definite conclusion of the authors.—Ed.]

Elephantiasis of Legs Treatment by Dermofibrolipectomy Followed by Free Skin Graft. Roberto Farina[5] (Univ of São Paulo) reports on the successful use of Macey's operation for the treatment of elephantiasis in 17 patients Considered incurable until recently, elephantiasis represents the final stage of chronic lymphedema. The massive enlargement of the leg hinders walking, and lymphatic stasis predisposes the affected limb to erysipeloid attacks, hyperemia and pain, as a result of which the general condition deteriorates, causing semi invalidism. Excision of all thickened tegument from the involved area and its replacement by free skin graft breaks the vicious circle—stasis, infection, increased stasis, fresh infection—and is based on the irreversibility of the fibromatous process involved in elephantiasis. No attempt is made to suture the grafts, which are spread out on petrolatum gauze, then applied to the denuded areas, thereby reducing operating time Immobilization in plaster is essential, among other reasons, to ward off pain, prevent edema and maintain the graft in correct position. Although the procedure ignores the primary and widely disputed cause of the elephantiasis, it has, for the first time, made possible the control of the disease and restored the affected limb to nearly normal size and appearance.

[This seems a better procedure than the old Kondoleon operation.—Ed.]

Chronic Lymphedema of the Extremities and Its Management are discussed by John Watson[6] on the basis of 26 cases, distributed by the following classification among (*a*) congenital or familial (1 each), (*b*) lymphedema praecox (18), (*c*) infective lymphedema—filarial (1), nonspecific inflammatory (1), or syphilitic or tuberculous (none), (*d*) secondary to destruction of glands or trunks either by malignant involvement (none) or surgical extirpation, irradiation or both (3), (*e*) traumatic (none), and (*f*) reflux chylous lymphedema (1)

(5) An. paulist. med. e cir 65:299-306, April, 1953
(6) Brit. J Surg 41 31-37 July 1953.

Traumatic, localized distal edema requires appropriate tissue replacement, and malignant cases are excluded Mild, *early lymphedema of the lower extremity should be treated* conservatively by firm external support, preferably with firm elastic bandages, extending from the bases of toes to knee or midthigh, over a lisle stocking or layer of stockinet, firm, lace-up shoes, and by elevation of the foot of the bed at night and by sedentary work. Four patients were treated conservatively

Established lymphedema with secondary changes requires radical excision of subcutaneous tissues and deep fascia and use of a Wolfe graft This operation has been performed on 3 arms and 12 legs, and follow up has lasted up to four years The operation was usually confined to the area below the knees Except in two cases of incomplete excision and one of muscular hypertrophy, maximal calf circumference has been reduced to within an inch of normal and has been maintained No development of collateral lymphatic circulation through deeper channels has been noted Ankle swelling below the malleoli and around the Achilles tendon is difficult to correct, owing to the anatomy of the region. Convalescence must be gradual, and postoperative supports must be worn indefinitely

In severe lymphedema with skin deterioration or ulceration, the skin cannot be replaced, and resurfacing with split skin grafts—after excision of the affected skin, subcutaneous tissue and deep fascia—is necessary In three patients *so treated, the early results have been satisfactory in limb* reduction, but whether or not the grafted skin can stand up under prolonged wear is difficult to assess Six patients were observed after Kondoleon operations

Management of Chronic Obstruction of Venous and Lymphatic Channels Darrell A. Campbell[7] (Ann Arbor Mich) discusses the 'post thrombotic" or "postphlebitic" syndrome, characterized by any combination of edema, skin pigmentation, subcutaneous fibrosis, varicose veins, skin ulceration, recurrent infection and disabling subjective symptoms of heaviness, fatigue and pain. The syndrome is the result of two processes thrombosis producing obstruc

(7) Missouri Med 50 675-678 September 1953

tion from within the vein with subsequent recanalization and loss of valves, and inflammation, producing obstruction from without the vein and lymphatic channels—the more important cause of the signs and symptoms Among preventive measures in the acute phase are early ambulation, exercises for bed patients, elastic supports, anticoagulants and



Fig 69 (left) —Example of severe post-thrombotic lymphedema before operation patient was a curiosity in a circus.
Fig. 70 (right) —Same patient after operation was able to return to circus to work as part of the crew
(Courtesy of Campbell, D A. Missouri Med. 50 675-678 September 1953)

antibiotics, and graded care and exercises in the early post-thrombotic period. Accurate diagnosis is usually reached by careful history and physical examination. Occasionally, special measures, like venography and ambulatory venous pressures, may be required.

Specific conservative measures which must become part of a "new way of life" for the patient include (1) maintenance of edema at a minimum, (2) wearing of elastic supports while erect, (3) regular 15 minute periods of sitting and elevation of the legs after 30 minutes of standing, (4)

two or more half hours' daily of complete recumbency with legs elevated, (5) 4 in. elevation of the foot of the bed, (6) careful daily washing and application of bland ointment, and (7) daily small doses of antibiotics or sulfonamides for recurrent infections.

Surgical measures include sympathectomy, femoral vein ligation and excision of the ulcer Sympathectomy, by rendering the foot incapable of sweating, controls the recurrent *secondary streptococcic infections that arise in chronic* epidermatophytoses After poor results with femoral vein ligation, the author concludes that it is physiologically unsound to treat a state resulting from venous obstruction and inadequate return by further retarding of venous circulation. With larger ulcers, the secondary varicose veins are excised with the ulcer in continuity followed by split thickness grafts.

When massive lymphedema, with or without ulceration, is the most prominent post thrombotic feature (Fig 69), radical excision of the skin and all fibrotic subcutaneous tissue with replacement by split thickness skin grafts has given good results (Fig 70) Areas previously avoided—including the dorsum of the foot, around joints, over bony prominences—are now excised With proper postoperative advice and continuous care and encouragement, such patients can safely return to their former occupations

Injuries to Large Lymph Ducts A. Lee McGregor[8] (Johannesburg, South Africa) observes that the lymphatic system serves as a collecting system, as a transport of chyle and continuously forms lymphocytes Death due to persistent loss of chyle from the circulation is the result of the loss of fat and proteins Spontaneous fistulas are more refractory and difficult to deal with than traumatic ones.

Severance of the thoracic duct, which is commoner on the right in closed trauma and on the left when due to penetrating wounds, is followed after about four days by sudden onset of severe dyspnea, pallor, cyanosis and a rapid thready pulse Symptoms are relieved by aspiration of the fluid, but reappear with its reaccumulation which may occur within

(8) Brit. J Surg. 40 569 574 May 1953

12 hours. Emaciation follows chylothorax rapidly with a progressive decrease in the total protein of the blood.

CASE 1.—During dissection of the tenth thoracic ganglion, in a first stage, right-sided thoracolumbar sympathectomy for hypertension on a man, 54, a flow cycle of chyle was noticed. After the neurectomy the two ends of the duct were exposed and ligated, care being taken not to strangulate tissue. The injured structure, taken to be the thoracic duct, was situated lateral to the vena azygos.

CASE 2.—During a right-sided sympathectomy of the Smithwick type for denervation for intractable renal pain in a young man, a flow of chyle was seen. On the inner aspect of the right crus of the diaphragm, at the level of the first lumbar vertebra, was a flat, delicate, weblike structure 2 in. long by ½ in. wide. It was connected to large lymph trunks at each apex and had a tear in the center. The sac, which was the cisterna chyli, was so tenuous that it was ligated at each end and removed. Convalescence was uneventful.

Experimentally it is all but impossible to cut off the lymph entry to the vascular system. In relation to thoracic duct and cisterna, any flow of chyle should be stopped. In other situations leaks are usually insignificant. The cisterna chyli may be removed and the thoracic duct tied without harmful consequence. Because of the frequency of surgical procedures in the region of the great lymph trunks, the surgeon must be duct conscious.

The ligature used to occlude the thoracic duct should be of unabsorbable material, and neighboring tissue should be placed over the ligated duct end. No drains should be used.

ABDOMEN—GENERAL

Right Upper Quadrant Pain in Salpingitis and Other Abdominal Diseases Explained by Absorption of Exudates from the Peritoneal Cavity through the Diaphragm. According to Povl Holm Nielsen[9] (Copenhagen), right upper quadrant pain which may occur in salpingitis and other abdominal diseases or after laparotomy constitutes a well defined syndrome with an unequivocally verified pathoanatomic basis. This is a disease of the serous membrane of the right subphrenic space resulting from an accumulation of

(9) Acta chir. scandinav. 104: 435-446, 1953.

exudate below the diaphragm due to the physiologic absorption of exudates from the peritoneal cavity through the diaphragm Approximately 10% of all patients with salpingitis have a characteristic piercing pain in the upper abdomen, localized usually in the region below the right costal margin.

Autopsy of patients with peritonitis and peritoneal carcinomatosis lends support to the view that the absorption of exudates and cells from the peritoneal cavity in man occurs principally through the lymphatic vessels in the diaphragm, just as has earlier been shown in animals Autopsy of patients with peritonitis has shown an increase in inflammatory changes under the diaphragm and a spread of the inflammation through all the layers of the diaphragm. When there are adhesions in the abdomen, more adhesions have been found in subphrenic areas In carcinomatosis, irrespective of the site of the primary tumor, implantation metastases were either pre eminently or exclusively located in the serous lining of the two subphrenic spaces and in the small pelvis and the omentum. The disease of the serous membrane of the subphrenic space and the attendant right upper quadrant pain in salpingitis are due to the absorption of exudates through the diaphragm This pain is often misdiagnosed and the commonest incorrect diagnosis has been pulmonary infarct

Pathogenesis of Ascites in Peritoneal Carcinomatosis Povl Holm Nielsen[1] (Copenhagen) does not accept previous theories concerning ascites in peritoneal carcinomatosis. He has demonstrated in animals that particulate matter, cells and exudates are absorbed from the peritoneal cavity through the lymphatics of the diaphragm from which lymphatic drainage takes place almost exclusively in a forward direction through the sternal lymphatic trunks and sternal nodes to the supraclavicular nodes and central lymphatic trunks There is evidence that absorption from the peritoneal cavity in man is identical

In peritoneal carcinomatosis, tumor infiltration of diaphragmatic lymphatics, of nodes on the upper side of the diaphragm and of sternal nodes along the internal mam

(1) Acta path. et microbiol. scandinav 33 10-21 1953

mary vessels is extremely common Apparently, ascitic fluid accumulates only after the lymph vessels of the diaphragm have become so blocked that absorption through them is either greatly diminished or entirely impossible To confirm this hypothesis, India ink was injected during laparotomy into four patients with peritoneal carcinomatosis but no ascites The study bore out the contention that in man, as in animals, particulate matter is absorbed through the lymph vessels of the diaphragm, not through the thoracic duct Close correspondence between the accumulation of ink and the metastases to the supraclavicular lymph nodes indicated one route by which malignant cells are transferred from abdominal tumors to supraclavicular lymph nodes (Virchow's gland)

Injection of India ink into three patients with peritoneal carcinomatosis and ascites showed only sparse infiltration in the sternal nodes in two and no ink in one, proving diminution or blockage of absorption by ascites

Injection of tissue from transmissible plasma cell tumor into the peritoneal cavity in inbred mice has nearly always resulted in development of ascites together with peritoneal carcinomatosis in 10-12 days. In mice with carcinomatosis and ascites, studies showed no transport of ink from the peritoneal cavity into the lymphatics, whereas in control animals there were black mottling of the thin diaphragm and ink in the efferent lymph trunks along the sternum.

[This interesting explanation of ascites in the presence of carcinomatosis seems *very reasonable.—Ed.*]

Purpura Abdominalis, according to Alexander Zabin[2] (Malverne, N Y), is more common than is believed or diagnosed Henoch's purpura abdominalis is attributed to an anaphylactoid reaction resulting in capillary damage and consequent hemorrhage It is also now believed that Henoch's purpura abdominalis and Schönlein's purpura rheumatica are merely different manifestations of the same underlying condition. The symptoms usually fall into two main groups, articular and visceral, either of which is usually associated with a variety of skin lesions. Any joint may be involved with pain, tenderness and swelling Involve

(2) New York J Med. 53 1557 1559 July 1 1953.

ment of the intestines may give rise to localized or generalized abdominal pain. Abdominal spasm and rigidity may be localized or generalized, and masses, caused by hemorrhages, may be palpated. Hematemesis or melena may occur and distention may be present. Kidney involvement may also be present. Skin manifestations may or may not occur. Purpura is the classic lesion. Purpura abdominalis is important because it may simulate the acute surgical abdomen and lead to unnecessary surgery.

Careful inquiry regarding sensitivity to food or inhalation antigens, attacks of asthma, hay fever, urticaria or angioneurotic edema may be helpful in the diagnosis. Physical examination may sometimes be informative, but the physical findings may simulate the acute surgical abdomen. X ray examination may be helpful when the findings are characteristic. Laboratory studies are often of no help in the diagnosis. A valuable aid in establishing the diagnosis is the tourniquet test. Since the symptomatology of Henoch's purpura is based on decreased capillary resistance with its subsequent hemorrhages, therapy is based for the most part on correction of this condition. Prognosis for recovery after the acute attack is excellent. However, there is considerable likelihood of recurrent episodes. Purpura abdominalis can usually be classified into four types: (1) those showing diffuse nonlocalized peritonitis, (2) those simulating appendicitis, (3) those simulating intussusception and (4) those simulating perforation of a viscus. Differentiating it from an acute surgical condition of the abdomen is most important. It should always be considered in the diagnosis of the "acute abdomen" in both children and adults.

Man, 35, had generalized abdominal cramps, nausea and induced vomiting for 14 hours and was unable to pass any flatus. Enemas were ineffectual for gas or feces. He appeared acutely ill. The abdomen was full but not definitely distended. He had had appendectomy earlier. Tenderness, spasticity and rebound tenderness were present in both lower quadrants, especially on the right. No masses or organs were palpated. There was shifting dulness in the flanks, and auscultation disclosed intestinal "rushes" concomitant with his complaints of pain. X ray studies showed distended loops of small bowel, with fluid levels, and the x ray diagnosis was consistent with mechanical obstruction of the small bowel. After eight hours of ob-

servation an operation was performed because of suspected intestinal volvulus. Exploration disclosed hemorrhage into the wall of the ileum. A 4½-5 in. fragment of ileum was thickened, red and covered with fibrinous exudate, and the bowel proximal to this was dilated. There were several adhesions of the cecum and the ascending colon to the appendectomy scar The involved bowel was resected and the continuity established by end to-end anastomosis. The pathologic diagnosis was hemorrhage into all coats of the ileum, probably a case of intestinal (Henoch's) purpura.

Peritonitis Due to Appendicitis and Its Treatment According to Gosta Bohmansson[2a] (Örebro, Sweden), 240,000 patients were hospitalized at the Centrallasarettet in 1929-51 during which time the average mortality rate decreased from 5 to 2 8% In the surgical department mortality decreased from 3 7 to 2 4% The number of cases of acute appendicitis during the same period exceeded 10,000 with a mortality of 3 6% in 1929 and 0 5% in 1951. The incidence of perforated appendicitis during this period remained approximately the same The mortality rate for appendicitis in 1929-40 was 3.2% and in 1941-51, 0 9%

Appendicitis patients were classified into four groups, according to Schullinger (1) those with simple acute appendicitis, (2) those with acute, destructive, nonperforated appendicitis with circumscribed peritonitis of serous or serofibrinous type, (3) those with perforated appendicitis with local, circumscribed, purulent peritonitis and (4) those with perforated appendicitis with free, progressive fibrinopurulent, more or less diffuse peritonitis In group 1 mortality in 1929-40 was 0 8%, and in 1941-51 0.1% Corresponding rates for group 2 were 0 8 and 0 25%, for group 3, 6 2 and 3 6% and, for group 4, 21 and 9%

The decreased mortality is attributed to knowledge of fluid and electrolyte balance the parenteral administration of water, sodium and potassium chlorides and maintenance of the colloidosmotic pressure of the blood by means of whole blood and plasma transfusions. Among the important advances are improved treatment of thrombophlebitis and pulmonary embolism, advances in anesthesia and methods of preventing respiratory complications

The treatment of appendicitis did not vary in the two

(2a) Acta chir scandinav 105 11 26 1953

periods Uncomplicated appendicitis was treated with appendectomy and primary suture Abscesses were either not operated on or were merely opened up Appendectomy was performed whenever it could be done without too much difficulty and drainage was instituted for a few days in order to canalize the abdominal wall. Free peritonitis was treated with operation immediately on hospitalization, the appendix was removed and peritoneal exudation was left untreated As a rule primary suture was used, with drainage only if there were larger necrotic areas adjoining tissues

[This gratifying reduction in the mortality of acute appendicitis is being duplicated wherever it is understood how to gauge and correct the metabolic disturbances, especially those which are complications of the dehydration and vomiting in serious cases. This is another example of the beneficial results of the application of chemistry to medical problems.—Ed.]

LIVER AND SPLEEN

Surgery of Hepatic Neoplasms With Special Reference to Secondary Malignant Neoplasms Alexander Brunschwig[3] (Memorial Cancer Center, New York City) discusses principles for various types of partial hepatectomy and the results obtained.

TECHNIC —Small neoplasms near a margin are removed by wedge excision. A protruding portion is removed by simple transection of its base. A mass embedded near a surface is excised by elliptic or circular incisions. The entire left lobe is excised vertically *through* its base of attachment just to the left of the falciform ligament Ligation of the left hepatic vein is carried out at the end of the transection after the vein is secured by hemostats. With hand compression the larger vessels are closed and as transection proceeds the visible large arteries, veins and bile ducts are clamped. On release of pressure smaller vessels are secured. The entire right lobe *is detached by vertical transection along the plane just* to the right of the falciform ligament. Pressure upward against the porta hepatis reduces bleeding, and transection with the scalpel or cautery proceeds gradually the larger vessels and bile ducts being secured as they appear Following any type of partial hepatectomy a gauze pack is applied to the area of excision and removed in one or two days. Gelfoam is effective in arresting oozing of blood Soft rubber

(3) *Cancer* 6 725-742 *July 1953*

drains should be placed in the area and left for four to seven days Large curved needles with blunt points are used in suturing the parenchyma.

Indications for removal of large angiomas of the liver are eradication of a potential source of hemorrhage and excision of a neoplasm that, if permitted to grow, will cause distressing mechanical symptoms Primary malignant neoplasms of the liver are usually either malignant cholangiomas or malignant hepatomas When symptoms become evident, the neoplasms are usually in an advanced stage

Adherence to the liver by malignant neoplasms arising in adjacent viscera is no contraindication to operation that must include resection en masse of the adhered to portions of the liver and the primary growth Radical operations may be indicated for liver metastases in the presence of recurrent carcinoma elsewhere in the abdomen and for palliation

The great advances in modern supportive therapy for the surgical patient, especially the development of blood banks, have made surgery of hepatic neoplasms much safer than in previous years. Solitary benign or malignant neoplasms should be excised whenever possible even if complete right or left hepatic lobectomy is necessary

[Results of only a few months standing, like some of these, are certainly not impressive.—Ed.]

Solitary Pyogenic Abscess of Liver Treated by Closed Aspiration and Antibiotics Report of 14 Consecutive Cases with Recovery A. J S McFadzean, K. P S Chang and C C Wong[4] (Univ of Hong Kong) report solitary pyogenic abscess of the liver in nine male and five female patients among 2,868 persons hospitalized during 1949-51 In 2 patients infection was by way of the hepatic artery, in the others, it was cryptogenic with bacteriologic and clinical evidence in 10 pointing to origin in the portal area Organisms isolated included Bacillus coli in pure culture in eight, anaerobic streptococcus in pure culture in one, B coli and anaerobic streptococcus in one, hemolytic streptococcus in one and Staphylococcus aureus in one Two abscesses were sterile

Solitary pyogenic abscess of the liver is a specific, recog

(4) Brit. J Surg. 41:141 152 September 1953

nizable clinical entity, not difficult to diagnose if due consideration is given to the clinical picture and to laboratory findings Usually the onset is insidious, with fever, malaise, chills, dull right upper abdominal pain aggravated by movement or inspiration or both, loss of weight, severe muscle weakness, anorexia, vomiting and, occasionally, such respiratory symptoms as cough, dyspnea, or both On hospitalization, toxemia, fever, involuntary abdominal rigidity, enlarged and tender liver were usually noted. In some, edema of the chest wall, clubbing of fingers, impaired air entry at the right base and possible x ray evidence of a high and domed diaphragm and consolidation in the right base of the lung were also noted Serum alkaline phosphatase values, estimated in seven patients, were always elevated

In all patients, pus was removed by closed aspiration and replaced by air, 10-20 cc lipiodol,* 500,000 units of penicillin and 0 5 Gm. streptomycin in 50 cc saline were then introduced into the cavity Antibiotic therapy intramuscularly was continued until the organism was identified and its sensitivity to antibiotics established The volume of the initial aspirate ranged from 90 to 1,700 cc Two or three aspirations were performed in all but one patient, who had six. With one exception, response to the first aspiration and the antibiotic therapy was highly satisfactory, with relief of abdominal pain, reduction of toxemia and return of temperature to normal. Eventual convalescence was always uneventful, and follow up of 13 patients three months after hospital discharge revealed that all were well and symptom free

Hepatic Regeneration after Partial Hepatectomy Experimental Study of the precise mechanism involved was attempted by P Mallet Guy, G Devic, J Feroldi, L. Eicholz, R Feit, Ricard, L Ringot, A. Ahualli and H Cassinelli[5]

In dogs hepatic "regeneration" takes place in the sense that the weight of the liver returns to normal within six to eight weeks after resection of 25 70% of parenchyma. This is not an actual reconstitution of the excised lobe but diffuse hypertrophy of the remaining parts This process

(5) Lyon chir 48 846 861 October 1953

can be repeated successively, resulting in very large liver weight.

Removal of the middle left and main left lobes resulted in a 40% weight loss of the liver The extent of regeneration was measured by weighing the amount removed and the total weight of the regenerated liver removed 21 days after the original operation. Histologic examination three weeks after ablation of 40% of the liver showed good regeneration of the weight of the hepatic parenchyma but revealed no characteristics attributable directly to the process of regeneration. No animal died of hepatic insufficiency and changes in the chemical tests appeared only after removal of 70% of the liver

Another group of dogs underwent the same operation but from the 3d to 20th day received 2 Gm. methionine daily, in still another group, folic acid and vitamin B_1 were also added. Neither methionine alone nor this drug with vitamins modified the regenerative process.

Perarterial hepatic neurectomy, whether carried out simultaneously with the hepatectomy or eight days before, did not influence the process of regeneration.

Effect of Portacaval Shunt on Estimated Hepatic Blood Flow and Oxygen Uptake in Cirrhosis was studied by S E Bradley, C. M. Smythe, H. F Fitzpatrick and A. H. Blakemore, with A. I S Macpherson and A. Gammeltoft.[6] In 10 of 12 patients the estimated hepatic blood flow (EHBF) was measured by the bromsulfalein method before and after establishment of the portacaval shunt, and in all 12 hepatic arteriovenous oxygen differences were measured. The EHBF averaged 1,266 ± 282 ml./minute (range, 940-1,780 ml.) before operation. It decreased in every instance postoperatively, falling on the average to 845 ± 284 ml./minute (range, 480-1,490 ml.) The data were insufficient to permit accurate evaluation of the type of surgical procedure (end to-side portacaval anastomosis in three, side to-side portacaval anastomosis in two and end to-side splenorenal venous anastomosis in five) in terms of its effect on EHBF However, the largest reductions followed side-to-side portacaval anas-

(6) J Clin. Invest. 32:526-537 June, 1953.

tomosis, and the smallest, splenorenal venous anastomosis. In association with the fall in EHBF, hepatic extraction of bromsulfalein increased in six patients and was relatively unchanged in four. On the average, the value rose from 26.5 ± 12.9% to 42.9 ± 12.5%, a highly significant change.

The hepatic arteriovenous oxygen difference increased after portacaval anastomosis in 9 of the 12 patients, average increase for the group as a whole being from 4.1 ± 0.6 to 5.8 ± 1.5 ml./100 ml. blood. Calculation of total "hepatic oxygen uptake" from simultaneously determined values for EHBF and hepatic arteriovenous oxygen difference yielded figures (average, 50.9 ± 13.9 ml./minute) which agreed with those obtained in other patients with cirrhosis. There was no significant change postoperatively indicating an inverse correlation between EHBF and hepatic arteriovenous oxygen difference. This calculation of the "hepatic oxygen consumption" provides at best an estimate of the true value. An undetermined volume of oxygen has been removed from the portal blood which contributes to the total hepatic venous outflow.

Since portal venous pressure decreased in every instance immediately after the portacaval shunt was opened, it seems reasonable to attribute the fall in EHBF, observed as long as two years postoperatively, to a persistent reduction in portal venous pressure. The fall may therefore be considered a reflection of diminished hepatic portal inflow modified to some extent perhaps by secondary changes in hepatic arteriolar resistance and hepatic arterial inflow.

Management of Cirrhosis of Liver and Ascites with Particular Reference to Portacaval Shunt Operation. David V. Habif, Henry T. Randall and Harry S. Soroff[7] (Columbia Univ.) list the factors involved in formation of ascites in hepatic cirrhosis as (1) portal hypertension, (2) lowered osmotic pressure secondary to decreased serum albumin level, (3) disturbances in the metabolism of sodium and water and (4) abnormal hormonal state. The most important aspect of management of ascites and edema is a rigid low sodium diet. Renal retention of sodium can be ascribed solely to increased tubular reabsorption.

(7) Surgery 34: 580-606, September, 1953.

Ion exchange resins are poorly tolerated by patients with severe liver disease and should be administered cautiously if at all A positive sodium balance on a rigid low sodium diet may be changed to a negative one by the use of ion exchange resins The expected efficiency of the resin is about 1 mEq sodium ion/Gm resin when the dietary intake of sodium is moderate (30 mEq) The most common complication is acidosis Mercurials, augmented by ammonium chloride, have a negligible effect in producing sodium diuresis when maximal ascites formation is recurring

The portacaval shunt operation should not be undertaken until liver function improves and ascites has been stabilized or reabsorbed Patients with cirrhosis, ascites and bleeding from esophageal varices should have bleeding controlled with an esophageal balloon or transesophageal ligation of varices Immediate decompression of portal pressure should not be attempted

Before operation, any hypoalbuminemia should be corrected with salt poor albumin, intravenously, to restore normal osmotic relationships Following operation, a low sodium diet should be given until the patient excretes enough sodium in the urine to indicate the re-establishment of normal balance thus preventing accumulation of ascites

Peripheral Blood Picture after Operation for Portal Hypertension. The main objective of surgery for portal hypertension is to prevent recurrence of serious hemorrhage by reducing portal venous blood pressure or by diverting portal blood from the dangerous cardioesophageal region. The second is to improve the blood picture when there is persistent and severe reduction in the number of circulating leukocytes and platelets A. I. S Macpherson and James Innes[8] (Univ of Edinburgh) report 12 cases of portal hypertension in which the surgical treatment did not involve splenectomy in 7 the operation was to relieve the portal hypertension by anastomosis of the portal vein and inferior vena cava and in 5 to reduce splenic blood flow by ligation of the splenic artery The changes in peripheral blood were compared with those in 46 cases of portal hypertension after splenectomy

(8) Lancet 1 1120-1123 June 6 1953

The persistent leukopenia and thrombocytopenia of portal *hypertension are rapidly relieved by splenectomy* This suggests a relationship between the levels of leukocytes and platelets in peripheral blood and enlargement or functional overactivity of the spleen. After portacaval anastomosis, pulp hyperplasia persisted and in no case was the blood picture improved After ligation of the splenic arterial supply, the spleen did not decrease in size nor was improvement noted in the blood picture except in one case with extensive infarction. It may be inferred that the reduction in the leukocytes and platelets is directly related to some influence derived from the cellular components of the enlarged spleen.

In no case was there any evidence that any of the operations benefited the red blood cell and hemoglobin levels other than by control and prevention of esophageal bleeding

Experiences with Portacaval Anastomosis in Treatment of Portal Hypertension. Charles B Ripstein[9] (State Univ of New York, Brooklyn) lists Tocantins' classification of factors besides increased portal pressure which are involved in the production of esophageal varices. (1) Extravascular defects—mucosa effects of mechanical trauma from food and diaphragmatic motion and from regurgitation of acid gastric juice on the raised ridges of the lower esophagus and the underlying veins in the submucosa. (2) Vascular defects—atrophy of the vein wall due to mechanical factors of diaphragmatic movement, negative intrathoracic pressure and portal hypertension. (3) Intravascular defects—deficiencies in the clotting mechanism from chronic congestion of the spleen, leading to increased destruction of platelets and hypoprothrombinemia from impaired liver function.

Relief of portal hypertension will correct only one of these factors and there is reason to doubt that such a measure will be of great value in long range therapy Though the cirrhotic liver can tolerate an Eck fistula, the resultant reduction of blood flow leads to interference with several hepatic functions.

In 30 patients having surgery for portal hypertension

(9) Surgery 34 570-579 September 1953.

cirrhosis was the cause in 20, in 8 it was extrahepatic obstruction of the portal system and in 2 obstruction was due to a vascular anomaly of the portal veins within the liver. All patients had esophageal varices, and gastrointestinal bleeding was the chief complaint. In 24 cases a shunt operation was performed, 14 splenorenal and 10 side to side portacaval anastomoses. Two patients died, a shunt operation had been abandoned in both instances.

Operations were disappointing in the 20 cirrhotics. Results of liver function tests showed no improvement in any patient and a tendency toward increased liver damage in all. Hepatic failure with coma for 24-48 hours occurred in four. These four recovered from the operation, but died within one year of liver failure despite disappearance of varices and ascites. Of these 20, 3 remained well more than one year, 9 derived temporary benefit but relapsed or died within one year and 5 showed no improvement.

In the group with extrahepatic portal obstruction, three had lasting improvement and four had only temporary remissions.

Two patients with portal obstruction due to intrahepatic vascular anomalies were father and son. Both had hereditary hemorrhagic telangiectasia. Operation was abandoned in the father because of acute cardiac failure. He subsequently died of massive hemorrhage from acute peptic ulceration of the esophagus. The son had a side-to-side portacaval anastomosis. Several months later, because of further bleeding, a 90% gastric resection, splenectomy and bilateral vagectomy were performed. There were no episodes of bleeding for two years.

[This report is so pessimistic that the future of the procedure certainly seems doubtful.—Ed.]

Intrahepatic Cholangiojejunostomy with Hepatectomy

A modification of the Longmire-Sandford technic was used successfully by Alfonso Bonilla Naar[1] (Bogotá, Colombia), in two patients, 62 and 54, with extrahepatic cancerous lesions. Instead of terminolateral hepaticojejunal anastomosis, the hepatic duct was inserted into the jejunum and fastened to a rubber catheter with a knot of chrome catgut

(1) Rev brasil. cir 24:313-318 December 1952

Also, at the point where the duct entered the jejunum, a silk purse-string suture was used to secure both members in the proper position, with the jejunum drawn up and with traction exerted simultaneously on the duct (already attached to the catheter that is brought out through an opening farther down) before the suture was tied Placement of the jejunum is facilitated if an excavation is made in the liver parenchyma at the time the duct is dissected If it is necessary to bring the jejunum up in a loop, the part that is doubled back must be fixed with a low laterolateral anastomosis to avoid infection of the bile ducts by the intestinal contents. The operation then continues routinely oxidized cellulose or a free graft of epiploon fastened in place with chrome catgut sutures is used to secure hemostasis and to prevent bile drainage, the jejunum is fixed to the peritoneum as it is being closed, and the rubber catheter (subsequently to be removed) is brought out through an opening in the abdominal wall (Witzel's technic)

Although this procedure is accompanied by grave risks, it affords relief in many cases of cancer that would formerly have been considered hopeless. It will probably provide a definitive cure in patients with cicatricial stenosis and, modified, may also prove to be the procedure of choice for children with partial or total atresia

Partial Hepatectomy Observations on an Illustrative Case Heneage Ogilvie[2] (Guy's Hosp) writes that accepted indications for partial hepatectomy are few, with rare justification for malignant disease

Man 28 operated on in 1949 for tumor of the posterior rectal wall 3 in. above the anorectal ring, had enlarged glands in the mesorectum, nodules in the pancreas and a lump on the diaphragmatic surface of the right lobe of the liver Specimens taken from the hollow of the sacrum and the liver contained deposits of the same tumor found in the rectum. A year later he was still in excellent health and the only abnormality noted was a small tumor of the posterior aspect of the rectum slightly fixed to the sacrum. Examination of the previous sections revealed an argentaffin tumor of the rectum. In May 1951 exploration revealed enlarged nodes in the pelvis and a billiard ball-sized lump in the dome of the right lobe of the liver A transverse colostomy was done. In June the rectum and lower half of the pelvic colon with the glands were removed

(2) Brit. M J 2 1136-1138 Nov 21 1953

and the pelvic colon anastomosed to the stump of the rectum end to-end. In August, the metastasis in the liver was removed and in January 1952 the colostomy was closed.

For removal of the liver metastasis, the right thorax was opened and the diaphragm incised allowing the tumor to bulge through. The knife was laid aside and a fine-pointed hemostat used, closed, for cutting the liver substance, taking slow gentle strokes parallel to the margins of tumor. The instrument cut through the liver parenchyma almost bloodlessly, giving a sense of slight resistance when meeting fibrous septa. These were clamped, ligated and cut. When the tumor was removed the cavity left was like a tea cup, oozing very slightly. The wound was drained abdominally and the chest wound closed. The postoperative course, except for slight jaundice for a few days, was uneventful. He gained 30 lb. and returned to work. The pathologic diagnosis was argentaffin tumor or carcinoid of morphology similar to that in the rectum.

Splenectomy for Blood Dyscrasias. According to William D. Holden[2a] (Western Reserve Univ.), "splenism" is a normal physiologic state in which a measure of control is exerted by the spleen over the rate of discharge from the bone marrow of erythrocytes, granulocytes and thrombocytes. There are two theories concerning hypersplenism. According to the first, the spleen destroys unusual numbers of erythrocytes, granulocytes or platelets within the splenic pulp; these cellular elements circulating in the blood stream are sequestrated, and there is phagocytic activity by the splenic macrophages which destroy the cellular elements more rapidly than normal; as a consequence of the sequestration and rapid phagocytic activity, the spleen usually enlarges. According to the second, perhaps more generally accepted theory, the spleen and bone marrow have a hormonal relationship; the spleen interferes with the discharge of granulocytes and thrombocytes from the bone marrow, and there is excessive inhibition of discharge from the bone marrow by the spleen. Examination of the bone marrow is a prerequisite to the diagnosis of hypersplenism, and will also rule out the presence of hypoplasia of the bone marrow.

Hypersplenism is classified as either primary or secondary. In primary hypersplenism, the thrombocytes in the circulating blood diminish in number, and the diminution must be observed on repeated examinations. When no other cause

(2a) Postgrad. Med. 13: 507-512, June 1953.

for the thrombocytopenia can be found, the condition is called idiopathic thrombocytopenic purpura. If the granulocytes are depressed, the disease is termed primary splenic neutropenia. If both thrombocytes and granulocytes are depressed, panhematopenia, or perhaps pancytopenia, characterizes the syndrome In splenic neutropenia and panhematopenia the spleen is always palpable, but in idiopathic thrombocytopenic purpura the spleen is usually enlarged, but may not be palpable In most instances of primary hypersplenism there is associated anemia which may be due to hemolysis, blood loss or interference by the spleen with the development of the erythroid elements in the marrow The cause of the anemia is not always apparent.

Splenectomy is advisable in adults with idiopathic thrombocytopenic purpura, but not in children, many of whom will have spontaneous remissions. About 80% of patients will be completely cured after splenectomy Splenectomy may produce immediate response in panhematopenia.

Splenectomy will not benefit patients with congenital hypoplasia or even acquired hypoplasia of the bone marrow If splenectomy fails to relieve patients with various hypersplenic syndromes, an accessory spleen left in the peritoneal cavity may be responsible

Cyclic Neutropenia Report of Case Treated by Splenectomy is presented by William D Coventry[3] (Duluth) This rare hematologic disorder is characterized by severe neutropenia or agranulocytosis recurring at approximately 21 day intervals The neutropenic phase lasting five to eight days is usually accompanied by mild fever and localized superficial infections of the skin or mucous membranes The disease continues for years without impairing the general health

Girl, 16 seen first in October 1948 three weeks after delivery of a normal male infant, had severe furunculosis of the groins and buttocks. For as long as she could remember she had had repeated superficial infections of the skin and mouth, though during pregnancy she had none. The hemoglobin level was *9 7 Gm./100 ml.*, erythrocytes 3,400,000 and leukocytes 3,850/cu mm., with 11% neutrophils, 26% monocytes and 60% lymphocytes. She responded to transfusions, antibiotics and staphylococcus toxoid. Recurrent in

(3) J.A.M.A 153 28 31 Sept. 5 1953

fections persisted and serial leukocyte counts established the diagnosis of cyclic neutropenia.

In May 1950, splenectomy was performed, the spleen weighed 280 Gm. The postoperative course was uneventful and there was a sharp rise in the leukocyte count to 10 000/cu. mm. with 87% neutrophils. Reversion to previous levels began on the third day and 18-21 day cycles of neutropenia similar in degree to those noted before splenectomy recurred at the usual intervals. She again became pregnant in May 1951 and, except for pyelitis, had no infection. Delivery of a normal male in December was uncomplicated. The first postpartum cycle of neutropenia was again accompanied by severe furunculosis, this time of the vulva. During the next nine months, there was no periodic infection, but when last seen (October 1952), two recent cycles had been accompanied by gingivitis with lymphadenitis and severe pharyngitis. Several more severe attacks occurred subsequently.

The cause of this disorder is obscure. In about half the cases, onset is in infancy. Treatment with various hematinic drugs, hormones, antibiotics, vitamins, antiallergic drugs and vaccines has failed to alter the cyclic changes in the neutrophils. The evidence on the use of corticotropin is conflicting.

A review of eight cases from the literature indicates that splenectomy will be beneficial if the spleen is considerably enlarged, especially in an elderly individual.

THE BILIARY TRACT

Studies of Extrahepatic Biliary Obstruction in the White Mouse by Fluorescence Microscopy. Allan L. Graffin and Verne E. Chaney, Jr., with Ellen G. Corddry[4] (Johns Hopkins Univ.) have applied fluorescence microscopy to study of the caliber and character of the biliary canaliculi of white mice—as delineated by the fluorescent dye, vasoflavine—at varying intervals after ligation and division of the extrahepatic biliary ducts, with and without simultaneous removal of the gallbladder. The studies were carried out both in vivo with chloral hydrate anesthesia and immediately after the unanesthetized animals were killed. The findings were remarkably consistent and indicated that in

(4) Bull. Johns Hopkins Hosp. 93 107 124 August, 1953

extrahepatic biliary obstruction, irrespective of duration (*to two months*) *there is no generalized or, with few exceptions, even localized dilatation of the biliary canaliculi.* No suggestion of canalicular rupture or leakage of dye (and so presumably of bile) into blood or lymph was noted

Among severe limitations of the method is that, with the fluorescence microscope at relatively high magnification, the observation is confined to the most superficial portions of the hepatic parenchyma, the structural organization of the mouse liver is such that, at its surface, access is possible only to limited regions of the hepatic lobules Possible applicability of the findings to other mammals and man, as well as their validity in the mouse itself, must await further investigation.

Saline Concentration in Cholecystography Paul S Friedman and Leon Solis Cohen[5] (Philadelphia) state that oral ad



Fig 71 (left) —Before saline ingestion nonvisualization.
Fig 72 (right) —After saline administration. Gallbladder and calculi can be seen. (Courtesy of Friedman, P S., and Solis-Cohen, L. Am. J Roentgenol. 70 437-440 September 1953.)

ministration of saline (80% sodium sulfate 20% magnesium sulfate) during cholecystography improves visualization of calculi in poorly functioning gallbladders (Figs. 71 and

(5) Am. J Roentgenol. 0 437 440 September 1953

72) This improvement probably results primarily from a transient rise in gallbladder tone and intracystic pressure in the absence of emptying with consequent increased water resorption It may be secondarily affected by an increase in hepatic bile secretion

PROCEDURE.—The day before x ray examination the routine is noon, fatty meal consisting of bacon and eggs, toast with butter, milk, 6 p.m., carbohydrate meal consisting of fruit juice, tomato and lettuce salad without dressing, bread or toast without butter, Jello, tea with sugar but no cream 6.30 p.m., 2 teaspoons paregoric with water, 7 p.m., 1 tablet of priodax®/20 lb. body weight or 1 capsule of monophen/15 lb. Priodax® or monophen is taken with water at 15 minute intervals. Thereafter only water, tea with sugar or fruit juices are drunk. Nothing is eaten.

The day of examination the procedure is saline enema on arising no breakfast, 9 a.m., roentgen visualization and localization of the gallbladder area, then sharply coned films of varying densities are made with and without compression. When the gallbladder is faintly visualized, 1 teaspoon of saline in 50 cc. ice water is administered orally The patient is informed of the probable cathartic effect. X rays are made in erect and recumbent postures 10, 30 and 45 minutes after saline ingestion Another x ray is taken 45 minutes after a lecithin fatty meal

Risk of Liver Damage in Cholangiography Clinical and Animal Investigation J C Buemann and T Cl. Gertz[6] (Rigshosp., Copenhagen) after critical examination of 699 cholangiograms done within 12 years suspected possible permanent damage to liver tissue and bile ducts in only two patients Experiments in 12 rabbits showed no damage to the liver and bile ducts after cholangiography Continued clinical use of both 35% diodone and 25% hippodin in cholangiography accordingly appears to be justified, but 50% hippodin is excessively hypertonic and too toxic for some patients.

[This study reveals what is generally suspected about the relative harmlessness of cholangiography but it is comforting to have the information. —Ed.]

Management of Remaining Common Duct Stones by Various Solvents and Biliary Flush Regimen. R Russell Best, John A Rasmussen and Carlyle E Wilson[7] (Univ of Nebraska) studied the solvent effect on gallstones in vitro of 113 solutions Gallstones are composed of cholesterol, bili

(6) Acta chir scandinav 105 104 11* 1953
(7) A.M.A. Arch. Surg 67 839-853 December 1953.

rubin, calcium or any combination of the three Among solutions used were such fat solvents as ether and chloroform, surface tension lowering agents, calcium binding agents, natural fatty acids and hydrotropic, enzymatic and dispersing agents and such miscellaneous agents as strong and weak acids and boiling water The best solvent was warm chloroform, which caused no injury of consequence to either hepatic or ductal tissue when instilled into the dog in vivo Chloroform instillations into a T tube on two successive days in 10 patients with proved choledocholithiasis produced pain and nausea in only one nervous and un-co-operative patient but no ill effects in the others

Routine T tube drainage after choledochotomy permits early diagnosis of residual stone in the common duct by means of choledochography and provides an effective route for therapy If a residual stone is found in the common duct, a simplified regimen for biliary flushing for three days should be prescribed This includes 3 tablets of dehydrocholic acid (decholin*) with belladonna after each meal and at bedtime, ½ bottle (6 oz.) of magnesium citrate each morning before breakfast, 3 tablespoons of pure cream or olive oil before noon and evening meals each day and 1 tablet (1/100 gr) of glycerol trinitrate dissolved under the tongue before the evening meal each day The instillation technic involves syringing of the T tube to remove the bile from both the tube and the duct, on the first and second days of the flushing regimen, 4-5 cc chloroform, heated to 140 F is instilled into the side arm of the T tube, which should have a double lumen, on the third day, 1/100 gr glycerol trinitrate is given sublingually and five minutes later 5 cc. ethyl ether is instilled into the T tube A recheck by choledochogram is made several days later, and if stones are still present the regimen is repeated after 7 14 days

This treatment failed in 2 of 14 patients, in 1 because of many stones and in the other because of failure to co-operate Since stones or debris are often present in the common duct unless choledochostomy is done, use of the three day flush regimen is recommended after each cholecystectomy about a week after operation and it should be repeated in another two weeks

Management of Benign Lesions of Common Duct is discussed by Warren H. Cole[8] (Univ of Illinois) Most cases of obstructive jaundice in infancy are congenital, caused by atresia or agenesis of the ducts If biliary structures are visualized outside the liver, patency may be tested by aspiration of the gallbladder followed by injection of physiologic saline stained with methylene blue The dye can be seen as it passes into the duodenum, but if doubt still exists, the duodenum can be aspirated and the opening closed with a 5-0 silk suture In a few cases obstruction is caused by adhesions, presumably congenital, at the posterosuperior margin of the duodenum These may be released by blunt dissection. When an extrahepatic duct containing bile is found, but atresia of the distal end exists, anastomosis to the intestinal tract is necessary It is preferable to use the gallbladder or the proximal stump of the common duct if it is much dilated or if the cystic duct is rudimentary In infants, anastomoses may be made to the duodenum without deleterious effects of reflux. Occasionally obstruction of the duct in infancy is caused by a mucous plug or by inspissated bile

There is difference of opinion regarding incidence of stones in the common duct and when the common duct should be opened. In 211 consecutive cholecystectomies, Harridge and Helsby explored the duct in 19% and found stones in 9%

Although the classic manifestations of stones in the common duct are epigastric or right upper quadrant pain followed in 48 hours by jaundice and acholic stools, many patients with stones have no jaundice It is important to differentiate stones from virus hepatitis and carcinoma of the ampulla of Vater Blood is almost always present in the stool with carcinoma of the ampulla, whereas it is rarely found with stones in the common duct. With virus hepatitis severe enough to produce jaundice, results of liver function tests are usually positive Cole prefers the thymol turbidity, alkaline phosphatase, cephalin flocculation tests and, in the later stages of the disease, observation of the albumin globulin ratio With carcinoma of the head of the pancreas,

---

(8) J Iowa M. Soc. 43:489-493 December 1953

pain is rarely present in the early stages, and once the stools become acholic they rarely contain bile again unless operation is performed Intermittency of cholic and acholic stools in patients with stones in the common duct is well known.

Absolute indications for opening the duct are palpable stones or dilatation of the duct with jaundice Other less definite indications are jaundice, thickening of the duct wall and dilatation of the duct if small stones are present in the gallbladder, and the cystic duct is large At operation care should be taken not to force stones upward into the intrahepatic ducts A T tube is inserted for drainage after exploration and left in place 14-16 days. A cholangiogram with diodrast* should be performed in every patient having choledochostomy for stones. Vitamin K should be given pre and postoperatively If all stones are removed the results should be excellent in 90-95% Mortality rate for choledochostomy should not exceed 2-3%

The existence of obstructive lesions at the ampulla of Vater is no longer debatable The only doubt now is whether or not true spasm or dyskinesia exists Cole believes that although true spasm may develop, fibrosis resulting from some type of inflammation is a more important factor

Primary Gallbladder Disease in Children, although uncommon may be an unrecognized cause of long standing upper abdominal pain, colic, vomiting and transient jaundice Frank Glenn and Malcolm R Hill, Jr[9] (New York Hosp Cornell Med Center) describe acute and chronic cholecystitis in seven children aged 1 15

CASE 1—Boy, 15 had right upper quadrant pain for 30 hours. For five years he had had increasingly frequent attacks of dull right upper quadrant pain, anorexia and nausea During one attack a normal appendix was removed, and the gallbladder was described as distended with clear bile. The last attack was accompanied by colicky pain radiating to the right subscapular area, vomiting and several watery bowel movements. There were minimal abdominal spasm and moderate right upper quadrant tenderness. The white blood cell count was 13,800 A previous gallbladder series showed nonfunctioning gallbladder and marked enlargement with poor function on a repeat series. Diagnosis was acute cholecystitis, and at cholecystectomy the mucosa of the gallbladder was hemorrhagic,

(9) Ann Surg 139 302 311 March, 1954

ulcerated and covered by a fibropurulent exudate There were no stones. Five years later the patient was asymptomatic.

CASE 3—Girl, 5, had abdominal colic and vomiting after meals for 4½ years, occurring with increasing frequency Gallbladder studies revealed a functioning gallbladder containing many stones. Low fat diet provided slight decrease in symptoms. Diagnosis was chronic cholecystitis with cholelithiasis, and cholecystectomy was performed The gallbladder was thickened and contained stones, and microscopic examination revealed thickening of all layers with increased fibrous tissue and lymphocytic infiltration She was well after four years when following a planned normal diet

Acute cholecystitis in childhood is usually associated with acute systemic disease Acute cholecystitis in the adult following unrelated surgery is a well established fact. Causative factors may be the same with biliary stasis and concentration from decreased hormonal gallbladder stimulation, dehydration and sphincter spasm The extrahepatic obstructive jaundice of cholecystitis in childhood may be due to common duct and periductal inflammation rather than duct obstruction by stone A history of jaundice is reported as high as 26-43% in children with gallbladder disease, however, 92% of children with recent jaundice have no common duct stones as compared with 52 5% in adults. This seems due to decreased incidence of cholelithiasis in cholecystitis of childhood which is 57-69% as compared to 93% in the adult disease

Treatment consists of cholecystectomy following proper preparation Common duct exploration should be carried out when indicated, but a history of jaundice in childhood does not indicate choledocholithiasis as it does in the adult

[The editor doubts that stasis is an important factor in the production of gallstones or even cholecystitis. Cholecystograms show the highest degree of stasis in the patient with visceroptosis yet such a patient seldom has cholecystitis or stones. On the contrary the type of individual who has the most rapid emptying of the gallbladder is the one most likely to develop gallstones.—Ed.]

Cholecystitis and Cholelithiasis in Childhood in one case are discussed by R. Kühlmayer[1] (Univ of Vienna)

Boy, 10, for a year had complained of pain in the regions of the navel and epigastrium. The pain was severe, appeared intermittently and disappeared spontaneously The day before hospitalization, he had pain in the right, middle and epigastric portions of the abdomen Temperature was 98.9 F., and he vomited bile three times. On

(1) Wien. klin. Wchnschr 8 553-555 July 3 1953

hospitalization, the temperature was the same and the abdomen moderately distended. There were pain on pressure and spasm of the right side near the navel. Urine values were normal. Leukocytes numbered 13,000 Acute appendicitis was diagnosed. Operation disclosed a perfectly normal appendix. Immediate digital exploration disclosed a tense gallbladder The cystic ducts contained a hazelnut-sized concretion. Further exploration revealed a highly distended gallbladder with acute, inflammatory, phlegmonous changes and extensive adhesions. On cholecystectomy numerous calcium bilirubin stones were found in the gallbladder Histologic study showed old chronic inflammatory changes with acute hemorrhagic cholecystitis. Postoperative course was uneventful.

Primary cholecystitis in children may be due to typhus, diphtheria, scarlet fever or any infectious disease of childhood. The mode of infection is not always clear Gallstone formation may be due to changes in the humoral constitution of the bile or to stasis Anomalies along the cystic duct or the ductus choledochus, glandular inflammation at the point of entry of the common duct into the duodenum and its compression by tumors have all been considered in relation to stasis. The more important cause is dyskinesia of the bile ducts The most common finding is combined primary cholecystitis and primary cholelithiasis. The literature indicates that primary cholecystitis comprises about 81.9% of all gallbladder diseases in children, whereas the corresponding figure in adults is 15% The symptoms are essentially the same as in the adult Pains are nonspecific, and there are nausea and vomiting In acute disease there are spasm, tenderness and rebound pain in the upper parts of the abdomen. There is leukocytosis. Diagnosis is difficult unless the possibility of this disease is borne in mind. In the acute stage, appendicitis is most often misdiagnosed. Radiography and appearance of the bile aid diagnosis. Therapy is predetermined because the disease is usually acute and cholecystectomy is the procedure of choice, especially if typhus bacilli are eliminated

Congenital Cystic Dilatation of Common Bile Duct Case Occurring in Infancy is presented by Philip Wrightson[2] (Wellington)

Newborn male infant vomited after each breast feeding beginning on the 3d day and was examined on his 5th day No significant physi

(2) Australian & New Zealand J Surg 22:110-115 November 1952

cal findings were found except for slight cyanosis. He was treated with oxygen and given bottle feedings and improved. His condition deteriorated gradually with daily vomiting, weight loss, dehydration and abdominal distention and was again examined on the 34th day of life. The abdomen was greatly distended and there were dulness to percussion everywhere except in the left lower quadrant and a large mass in the right side of the abdomen which could also be seen on x ray films. Diagnosis was hepatic secondary involvement from neuroblastoma and a needle was inserted into the mass to obtain a biopsy specimen, but a cystic cavity was entered and 170 cc. bile withdrawn A diagnosis of cystic dilatation of the bile duct was made and surgery undertaken immediately

Through a right supraumbilical paramedian incision a large cystic swelling was felt in the position of the common bile duct. Its anterior wall was firmly adherent to the superior border of the first part of the duodenum The gallbladder was present and small, lying to the outer side of the cyst with the duct apparently entering its posterior surface. The cyst was anastomosed to the first part of the duodenum. There was some vomiting postoperatively but he gradually improved and at age 1 was a healthy and active child who weighed 22 lb but still had feeding difficulties, vomiting a small amount of most meals There was no jaundice and the feces contained neutral fats in normal amounts. Three months later he ceased to vomit.

Congenital cystic dilatation of the common bile duct is a developmental defect The lower part of the common bile duct is either perfectly normal or reduced in diameter but there is no complete obstruction to the flow of bile Differential diagnosis must include hepatic tumor, erythroblastotic or syphilitic enlargement of the liver, hemangioma, hamartoma and secondary neuroblastoma of the liver, renal tumor, retroperitoneal tumor intestinal tumor and other biliary tract tumors The standard treatment is anastomosis of the duct to the duodenum so that the obstruction at the outflow from the cyst is relieved and the sphincter of Oddi by passed. Other suggested treatment includes excision of the cyst with anastomosis of the hepatic ducts to a Y limb of the jejunum or anastomosis of the Y limb of the jejunum to the cyst. Some surgeons have resected the cyst

Residual Stones in Common Bile Duct Question of Operative Cholangiograms Edward V Johnston, John M Waugh and C Allen Good[3] (Mayo Clinic and Found) studied 153 patients who had had choledocholithotomy with

(3) Ann. Surg 139 293 301 March, 1954

out operative cholangiograms to determine the incidence of residual stones The minimum period of follow up was two years, the average six.

There were 26 patients who had residual or recurrent symptoms of significance or whose postoperative cholangio grams were interpreted as revealing residual choledocholithiasis Of this group, 18 returned for evaluation and treatment. In 12 (8%), residual stones were overlooked at initial choledocholithotomy The diagnosis of residual stones was made on the basis of repeated postoperative cholangiograms in two patients In neither did symptoms develop from clamping of the T tube Subsequently one was asymptomatic and one had only moderate flatulence and constipa tion. Postoperative cholangiograms showed stones in nine, and in one, a residual stone was found on reoperation. In four, symptoms began immediately after the primary operation, but the average interval was seven months In three, symptoms subsided without operation One died of biliary obstruction and cirrhosis The other six had re-exploration. Four had multiple small stones at initial operation, at re-exploration, single stones less than 1 cm. in diameter were found

Recurrent symptoms in six were attributed to re formed stones, with symptoms recurring an average of 3 6 years after operation. In four, the stones were large and either soft or mushy In one re-exploration revealed a dilated, thickened common duct but no stones The sixth did not require re-exploration

Of the eight remaining patients, four had inflammatory stricture or stenosis near or of the ampulla of Vater and four had pancreatitis. The cholangiograms were negative for stones in all

In 15 of the 26 cases, reoperation was required with no resulting mortality Two who did not have reoperation died of biliary obstruction one from residual stone one from stenosis or stricture

Stones may be overlooked if they are embedded in crypts or ulcerations near the ampulla of Vater or dislocated up ward into the hepatic ducts or secondary radicles. Chol angiographic studies reveal that two right hepatic ducts

frequently exist The more medial duct joins the main right hepatic duct, to drain the dorsocaudal segment of the liver This dorsal angulation almost precludes entry of instruments into the duct, and removal of stones, even after localization by operative cholangiograms, may be difficult or impossible

Even in experienced hands, operative cholangiograms have not been technically satisfactory in 5-15% of cases and have proved inaccurate in about 10% The method must become more accurate before it can replace surgical exploration of the ducts by experienced surgeons or become routine during choledocholithotomy

Precautions in Treatment of Strictures of Common Duct Warren H. Cole[4] (Univ of Illinois) stresses the fact that operative trauma, usually during cholecystectomy, is the cause of at least two thirds of these strictures (Fig 73)

Precautionary measures in prevention include (1) adequate exposure of operative field, (2) adequate time for dissection and identification of structures, (3) awareness of congenital malformations, (4) cutting no structure until definitely identified, (5) exposure of junction of cystic and common ducts during cholecystectomy, (6) separate ligation of cystic artery and duct (7) control of arterial hemorrhage by pressure and accurate ligation of bleeding point, (8) beginning dissection at the fundus of the gallbladder when adhesions are dense, and (9) remembering that 65-75% of common duct strictures result from trauma.

With complete occlusion of the common duct, jaundice develops in 36-48 hours If the duct is cut and not tied, biliary fistula will develop if there is adequate drainage, if the peritoneal cavity has not been drained, bile peritonitis will develop Partial obstruction with delay of onset of jaundice may be caused by partial ligation with inflammation and fibrosis and collections of pus and bile The symptoms of chronic stricture are variable with variation in degree of obstruction dependent on severity of infection and inflammation.

Particular care must be taken with these patients, who are usually recovering from previous operations, may be

(4) Am. Surgeon 20 224 247 March, 1954

malnourished and may have some biliary cirrhosis with cellular necrosis Effort should be made to correct hypoproteinemia, hypoprothrombinemia, anemia and electrolyte

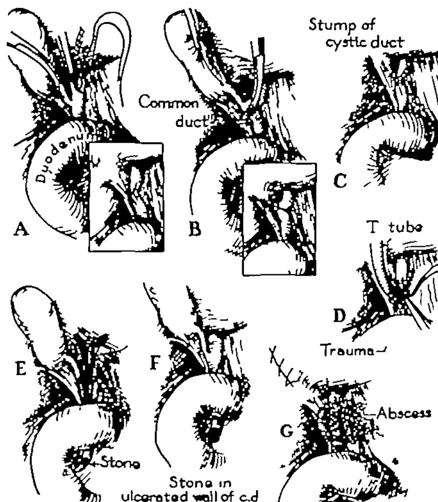


Fig 78 —Mechanisms in production of stricture of common duct: *A* transfixion with needle; *B*, ligation with cystic duct *C* ligation of cystic duct too close to common duct *D* chronic diffuse sclerosing pancreatitis *E* cholangitis; *F* ulceration of the wall by stone and *G* abscess or local collection of bile. (Courtesy of Cole W H.: Am. Surgeon 20 234 247 March 1954 from Cole W H [ed.] Operative Technic [New York Appleton-Century-Crofts, Inc. 1949])

deficiency, particularly potassium. Operation should usually be carried out as soon as possible, although the fact that adhesions are most dense 4-12 weeks after operation may slightly influence the choice of time for operation.

If end to-end anastomosis is not possible anastomosis to

a Roux Y arm of jejunum or to the duodenum must be performed If a remnant of duct cannot be found, a fistula can be produced by numerous aspirations of the liver hilus, which can later be attached to the end of a Roux Y arm of jejunum If a prosthesis is required, a T tube is preferred The tube is usually split so that part goes up the right duct and the rest up the left. In the absence of significant inflammatory changes no prosthesis should be used. In the presence of a thickened and inflamed duct wall, particularly if the lumen is small, a prosthesis should be used for 8-10 months. Good to excellent results should be obtained in 60% or more of patients

Extremely important in differentiation of duct obstruction from hepatic damage as the cause of the jaundice and acholic stools are the liver function tests, particularly thymol turbidity and cephalin flocculation and blood protein determinations.

Operation should be postponed in patients with mild symptoms, as many have occasional short attacks of jaundice and recover completely without surgery If portal hypertension from biliary cirrhosis causes hemorrhage from esophageal varices, splenorenal or portacaval shunt may be indicated. Splenorenal shunt is preferred because the portal vein is often thrombosed.

Intravenous Cholangiography Its Place in Radiologic Study of Biliary Passages According to J Sénèque, R Le Canuet, Ch. Debray, Marcel Roux and J Aussage[5] (Paris), biligrafin, a substance containing 64 32% iodine and of low toxicity, when given intravenously attains a sufficient concentration in the hepatic bile to make possible radiography of the large intrahepatic bile passages and of the cystic and hepatic ducts. The common duct can be visualized without entering the bladder

Although toxic reactions are few slow injection is indicated. Patients with a known intolerance to iodine should be pretested by either buccal, ocular or intradermal routes, or by injection of 1 cc. several minutes before starting the procedure In patients with parenchymatous diseases of the liver (icterogenic hepatitis, decompensated cirrhoses), ad-

(5) Presse méd. 62:281 285 Feb. 24 1954

ministration of the medium may aggravate pre-existing lesions and poor elimination result in poor contrast on the film. The drug is then eliminated by the kidneys and a urogram obtained.

Normally, the hepatic duct is visible 10 minutes after the dye is injected, and the cystic duct, a few minutes later Maximal visibility of the common duct is attained within 30-45 minutes after injection, which is the best time for radiography The gallbladder becomes visible after 15 minutes. The opacity begins at the infundibulum, then the contours of the bladder are visualized, while the center is still light The center becomes opaque last This fact is important since calculi or biliary tumors may thus be simulated.

Nonvisualization of the common bile duct may be due to poor elimination of the product by the liver in the course of cirrhosis or icterogenic hepatitis or to too rapid elimination of the dye toward the duodenum without sufficient accumulation in the biliary passages, such as may occur in biliary-digestive tract fistulas or surgical choledochoduodenal anastomosis.

Intravenous cholangiography is of utmost importance in demonstrating pathologic involvement of the common duct as well as changes in its form and caliber or in position of stones The function of the biliary passages can also be studied In the absence of the gallbladder (cholecystectomy, congenital absence) or with poor emptying, the intravenous route is the only one that permits objective demonstration of the common duct

New Method of Study of Biliary Passages, using radioselectan, is presented by R Nadal and J Vigneau[6] (Paris) The product contains 64 32% iodine and is administered intravenously in 20% concentration in 20 cc isotonic solution. It causes no nausea, vomiting or diarrhea. Only 1 of 14 patients had a sensation of heat and mild pruritus The patients were examined in the prone supine and Trendelenburg positions with satisfactory results In a group with previously normal cholecystograms and satisfactory gallbladder function it was possible to demonstrate that the dye passes rapidly through the liver and that the intra and ex

(6) Presse méd. 62 293 294 Feb 24 1954

trahepatic ducts are visualized first. The hepatic duct and its branches appear 15 minutes and the cystic duct 15-30 minutes after injection of the dye. Emptying of the bladder after administration of a test meal was the same with the intravenous as with the oral route.

Intravenous angiocholecystography offers many diagnostic advantages. Numerous calculi were demonstrated which were not visualized at two previous cholecystographies with other contrast mediums in a totally gastrectomized patient. In another patient, it permitted study of a cholecystointestinal anastomosis.

Results were particularly encouraging in cholecystectomized patients with symptoms of biliary tract involvement (calculi, inflammation, etc.) and in those suspected of having calculi in the bladder or cystic duct, cholecystitis without lithiasis, bladder anomalies, internal biliary fistulas and primary or secondary biliary dyskinesias.

Contraindications to use of this drug are hypersensitivity to iodine, Basedow's disease, severe changes in liver function, acute nephritis and severe hyperazotemia.

[This seems to be an excellent substance for cholecystography. It is surprising it has not been used more in this country. When the editor with Cole, Copher and Moore, introduced tetraiodophenolphthalein for this purpose 30 years ago, we stated that better substances would be found. That prediction has come true. It is of interest, however, that the criteria of diagnosis which we established then for cholecystography, regardless of the substance used, have remained the same.—Ed.]

Biliary Fistulas. John J. Byrne,[7] in reviewing 53 cases discovered at Boston City Hospital between 1932 and 1952, found 23 cases of external biliary fistula. Much can be learned concerning the type of fistula from the character of the discharge: mucous discharge without bile means complete stenosis of the cystic duct; bile-stained mucus, intermittent cystic duct obstruction; large quantities of bile, choledochal disease; large quantities of bile and pus, cholangitis. All 23 patients, average age 56, had upper abdominal discomfort and 9 jaundice. Each fistula followed surgical treatment for biliary disease: eight cholecystostomy, six cholecystectomy, seven choledochostomy and two biliary anastomosis. Cause of the fistula was gallbladder remnant

(7) Am. J. Surg. 86: 181-187, August, 1953.

in eight, stricture in nine, common duct stone in three, biliary intestinal anastomosis in two and cancer in one (Fig 74)—all representing surgical error in judgment or technic

Internal biliary fistula was found in 30 patients, average age 70, indicating their origins in long-standing biliary disease The anatomic pattern of the fistula in 24 was cholecystoduodenal, in 3 cholecystocolic and in 1 each cholecystogastric, cholecystocholedochal and choledochoduodenal.

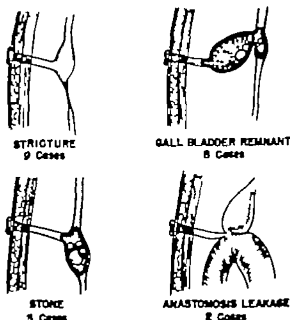


Fig 74 —Causes of external biliary fistula in 22 cases reviewed at Boston City Hospital. (Courtesy of Byrne J J : Am. J Surg 86 181 187 August, 1953.)

Gallstones were the cause in 29 and carcinoma of the gall bladder in 1. All 16 patients with gallstone ileus also had a fistula of cholecystoduodenal type Gallstone ileus may be suspected when there is small bowel obstruction without hernia or abdominal scars and with history of gallbladder disease X rays would suggest correct diagnosis if they disclose a stone in the lower abdomen at the site of the obstruction or a gas pattern associated with small bowel obstruction in the normal liver shadow Gallstone ileus is treated surgically by removal, after the stone has been milked from the constricting area, through an enterotomy

incision which is then closed transversely If the stone is faceted, exploration should be extended to make sure that no other obstructive stones are present.

Correct surgical treatment of cholecystoduodenal fistula depends on the presence or absence of choledocholithiasis In its absence, the gallbladder is excised and the fistula in the duodenum closed, in its presence the common duct is cleared of stones.

Cholecystocolic fistulas raise several unique problems (1) Passage of feces through the fistula into the biliary system can lead to severe cholangitis. (2) If the cystic duct is obstructed, passage of feces into the gallbladder can cause severe inflammation. (3) Large bowel obstruction may occur These problems suggest a colostomy of the ascending loop as the first stage in treatment in order to defunction the colon before it enters the fistula. If there is no obstruction, inflammation or cholangitis, good preoperative care of the large bowel followed by gallbladder excision with fistulectomy may be satisfactory

Cholecystogastric and choledochoduodenal fistulas are treated as are those between gallbladder and duodenum. One case of fistula between the gallbladder and common duct was treated by cholecystectomy, common duct exploration and removal of any duct stones.

Fibrosis of the Sphincter of Oddi. Richard B Cattell and Bentley P Colcock[8] (Lahey Clinic) attribute to fibrosis of the sphincter of Oddi some of the symptoms in patients with cholelithiasis Unrecognized fibrosis of the sphincter or stricture of the papilla may be responsible for recurrence or persistence of symptoms after cholecystectomy and may lead to the need for a secondary operation. Repeated operations for common duct stones are often required because of fibrosis of the sphincter The pathogenesis of fibrosis of the sphincter of Oddi and papilla of Vater is not fully understood Long-standing spasm, infection in the biliary tract, in the mucosa of the duodenum and at the head of the pancreas or stone in the common duct may be responsible.

Fibrosis of the sphincter of Oddi can best be demonstrated during exploration of the common duct It may be

(8) Ann. Surg 137 797-806 June 19 3

overlooked unless broad indications for choledochostomy are used At the time of exploration of the common duct, either at the primary or secondary operation, it is essential to demonstrate the patency and size of the sphincter and papilla, and this is best done by means of graduated dilators The incision in the common bile duct must be large enough to permit the passage of instruments The duodenum and head of the pancreas should be freed and elevated to change the direction of the common bile duct If a 3 mm. dilator cannot be passed easily through the ampulla, fibrosis of the sphincter or stricture of the papilla is probably present *Under these circumstances a transduodenal exploration* should be carried out, permitting exploration from each end.

If fibrosis is present one of two types of correction can be used depending on the degree and extent of the obstruction. Most can be relieved by forcible dilatation from above by means of graduated dilators Patency can be maintained by means of an indwelling tube, such as a T tube, which passes through the ampulla into the duodenum The second *method of correction consists of division of the mucosa of* the papilla and division of the sphincter muscle through the transduodenal approach. This *entails direct incision of* the sphincter with or without suture of the mucosa and insertion of a long T tube After common duct exploration has demonstrated that no obstruction is present at the ampulla, a short armed T tube is placed in the common duct and removed in 8-12 days. If definite fibrosis or stricture is present the long T tube is left in place for at least six months Forcible dilatation of the ampulla and sphincterotomy are followed by submucosal hemorrhage, edema, fibroblastic proliferation and later fibrosis Theoretically the tube must remain in place until absorption of the scar has *occurred* and smooth mucosal *healing* has resulted

Fibrosis of the sphincter or stricture of the papilla were found in 14 men and 35 women, ages 29 73 The symptoms encountered included all those commonly associated with calculi in the biliary tract Jaundice had been present in 27 patients and 32 had had previous cholecystectomy without relief from symptoms including 6 in wh[illegible] common

duct stone had been previously removed At surgery common duct stones were present in 13 at the time the fibrosis was discovered Moderate to pronounced dilatation of the common duct was found in 17 Forcible dilatation of the sphincter was performed in 35 by insertion of a long T tube Transduodenal sphincterotomy was performed in 10, in each of whom a long T tube was utilized Three had dilatation of the sphincter with implantation of a short T tube, and one had choledochoduodenostomy because subtotal gastrectomy had been done earlier There was no operative mortality Of 37 patients followed for six months or more, 28 had complete relief from symptoms and 6 were improved, 1 was a failure and 2 were dead

Accidental Injuries to Deep Bile Ducts in Cholecystectomy Karl Lehmann[9] (St Lukas Hosp, Copenhagen) reports that among 630 cholecystectomies there were 4 instances of injury to deep bile passages The causes of such injuries are (1) control of profuse and uncontrolled bleeding from the cystic or right hepatic artery by blind application of hemostatic forceps leading to injury of the hepatic duct, (2) excessive pull on the cystic duct to draw the choledochus up into a tip which is then ligated, or ligation of the cystic duct too near the choledochus thereby constricting it, (3) anatomic variations, including absence or extreme shortness of the cystic duct leading to mistaken identification of the choledochus for this duct, and (4) pathoanatomic changes, such as migration of gallstones, and inflammatory processes which may block the common bile duct thereby complicating an orienting survey of the field. Most injuries to deep bile structures occur during cholecystectomy

One of the principal prophylactic points is to avoid any severe hemorrhage during surgery It is advisable to begin the operation with isolation and ligation of the cystic artery Should hemorrhage occur, it can always be controlled by compression of the hepatic artery in the ligament by introducing a finger into the foramen of Winslow, after which hemostasis can be effected without any untoward risk. The cystic duct must never be divided until the sur

(9) Acta chir scandinav 105 195 07 1953

overlooked unless broad indications for choledochostomy are used At the time of exploration of the common duct, either at the primary or secondary operation, it is essential to demonstrate the patency and size of the sphincter and papilla, and this is best done by means of graduated di lators The incision in the common bile duct must be large enough to permit the passage of instruments The duodenum and head of the pancreas should be freed and elevated to change the direction of the common bile duct If a 3 mm. dilator cannot be passed easily through the ampulla, fibrosis of the sphincter or stricture of the papilla is probably present. Under these circumstances a transduodenal explora tion should be carried out, permitting exploration from each end.

If fibrosis is present one of two types of correction can be used depending on the degree and extent of the obstruction. Most can be relieved by forcible dilatation from above by means of graduated dilators Patency can be maintained by means of an indwelling tube, such as a T tube, which passes through the ampulla into the duodenum. The second method of correction consists of division of the mucosa of the papilla and division of the sphincter muscle through the transduodenal approach. This entails direct incision of the sphincter with or without suture of the mucosa and in sertion of a long T tube After common duct exploration has demonstrated that no obstruction is present at the am pulla, a short armed T tube is placed in the common duct and removed in 8-12 days If definite fibrosis or stricture is present the long T tube is left in place for at least six months. Forcible dilatation of the ampulla and sphincterot omy are followed by submucosal hemorrhage, edema, fibroblastic proliferation and later fibrosis. Theoretically, the tube must remain in place until absorption of the scar has occurred and smooth mucosal healing has resulted

Fibrosis of the sphincter or stricture of the papilla were found in 14 men and 35 women ages 29 73 The symptoms encountered included all those commonly associated with calculi in the biliary tract Jaundice had been present in 27 patients and 32 had had previous cholecystectomy with out relief from symptoms, including 6 in whom a common

duct stone had been previously removed At surgery common duct stones were present in 13 at the time the fibrosis was discovered Moderate to pronounced dilatation of the common duct was found in 17 Forcible dilatation of the sphincter was performed in 35 by insertion of a long T tube Transduodenal sphincterotomy was performed in 10, in each of whom a long T tube was utilized Three had dilatation of the sphincter with implantation of a short T tube, and one had choledochoduodenostomy because subtotal gastrectomy had been done earlier There was no operative mortality Of 37 patients followed for six months or more 28 had complete relief from symptoms and 6 were improved, 1 was a failure and 2 were dead.

Accidental Injuries to Deep Bile Ducts in Cholecystectomy Karl Lehmann[9] (St Lukas Hosp., Copenhagen) reports that among 630 cholecystectomies there were 4 instances of injury to deep bile passages The causes of such injuries are (1) control of profuse and uncontrolled bleeding from the cystic or right hepatic artery by blind application of hemostatic forceps leading to injury of the hepatic duct, (2) excessive pull on the cystic duct to draw the choledochus up into a tip which is then ligated, or ligation of the cystic duct too near the choledochus thereby constricting it, (3) anatomic variations, including absence or extreme shortness of the cystic duct leading to mistaken identification of the choledochus for this duct, and (4) pathoanatomic changes such as migration of gallstones, and inflammatory processes which may block the common bile duct thereby complicating an orienting survey of the field. Most injuries to deep bile structures occur during cholecystectomy

One of the principal prophylactic points is to avoid any severe hemorrhage during surgery It is advisable to begin the operation with isolation and ligation of the cystic artery Should hemorrhage occur, it can always be controlled by compression of the hepatic artery in the ligament by introducing a finger into the foramen of Winslow, after which hemostasis can be effected without any untoward risk. The cystic duct must never be divided until the sur

(9) Acta chir scandinav 105 198 207 1953

overlooked unless broad indications for choledochostomy are used. At the time of exploration of the common duct, either at the primary or secondary operation, it is essential to demonstrate the patency and size of the sphincter and papilla, and this is best done by means of graduated dilators The incision in the common bile duct must be large enough to permit the passage of instruments The duodenum and head of the pancreas should be freed and elevated to change the direction of the common bile duct If a 3 mm. dilator cannot be passed easily through the ampulla, fibrosis of the sphincter or stricture of the papilla is probably present Under these circumstances a transduodenal exploration should be carried out, permitting exploration from each end.

If fibrosis is present one of two types of correction can be used depending on the degree and extent of the obstruction. Most can be relieved by forcible dilatation from above by means of graduated dilators. Patency can be maintained by means of an indwelling tube, such as a T tube, which passes through the ampulla into the duodenum. The second method of correction consists of division of the mucosa of the papilla and division of the sphincter muscle through the transduodenal approach. This entails direct incision of the sphincter with or without suture of the mucosa and insertion of a long T tube After common duct exploration has demonstrated that no obstruction is present at the ampulla, a short armed T tube is placed in the common duct and removed in 8-12 days If definite fibrosis or stricture is present the long T tube is left in place for at least six months Forcible dilatation of the ampulla and sphincterotomy are followed by submucosal hemorrhage edema, fibroblastic proliferation and later fibrosis. Theoretically the tube must remain in place until absorption of the scar has occurred and smooth mucosal healing has resulted

Fibrosis of the sphincter or stricture of the papilla were found in 14 men and 35 women ages 29 73 The symptoms encountered included all those commonly associated with calculi in the biliary tract Jaundice had been present in 27 patients and 32 had had previous cholecystectomy without relief from symptoms, including 6 in whom a common

duct stone had been previously removed At surgery common duct stones were present in 13 at the time the fibrosis was discovered Moderate to pronounced dilatation of the common duct was found in 17 Forcible dilatation of the sphincter was performed in 35 by insertion of a long T tube Transduodenal sphincterotomy was performed in 10, in each of whom a long T tube was utilized Three had dilatation of the sphincter with implantation of a short T tube, and one had choledochoduodenostomy because subtotal gastrectomy had been done earlier There was no operative mortality Of 37 patients followed for six months or more, 28 had complete relief from symptoms and 6 were improved, 1 was a failure and 2 were dead

Accidental Injuries to Deep Bile Ducts in Cholecystectomy Karl Lehmann[9] (St Lukas Hosp, Copenhagen) reports that among 630 cholecystectomies there were 4 instances of injury to deep bile passages. The causes of such injuries are (1) control of profuse and uncontrolled bleeding from the cystic or right hepatic artery by blind application of hemostatic forceps leading to injury of the hepatic duct, (2) excessive pull on the cystic duct to draw the choledochus up into a tip which is then ligated, or ligation of the cystic duct too near the choledochus thereby constricting it, (3) anatomic variations, including absence or extreme shortness of the cystic duct leading to mistaken identification of the choledochus for this duct, and (4) pathoanatomic changes, such as migration of gallstones, and inflammatory processes which may block the common bile duct thereby complicating an orienting survey of the field Most injuries to deep bile structures occur during cholecystectomy

One of the principal prophylactic points is to avoid any severe hemorrhage during surgery It is advisable to begin the operation with isolation and ligation of the cystic artery Should hemorrhage occur, it can always be controlled by compression of the hepatic artery in the ligament by introducing a finger into the foramen of Winslow, after which hemostasis can be effected without any untoward risk. The cystic duct must never be divided until the sur

(9) Acta chir scandinav 105 195 207 1953

overlooked unless broad indications for choledochostomy are used. At the time of exploration of the common duct, either at the primary or secondary operation, it is essential to demonstrate the patency and size of the sphincter and papilla, and this is best done by means of graduated dilators The incision in the common bile duct must be large enough to permit the passage of instruments The duodenum and head of the pancreas should be freed and elevated to change the direction of the common bile duct. If a 3 mm. dilator cannot be passed easily through the ampulla, fibrosis of the sphincter or stricture of the papilla is probably present. Under these circumstances a transduodenal exploration should be carried out, permitting exploration from each end.

If fibrosis is present one of two types of correction can be used depending on the degree and extent of the obstruction. Most can be relieved by forcible dilatation from above by means of graduated dilators Patency can be maintained by means of an indwelling tube, such as a T tube, which passes through the ampulla into the duodenum The second method of correction consists of division of the mucosa of the papilla and division of the sphincter muscle through the transduodenal approach. This entails direct incision of the sphincter with or without suture of the mucosa and insertion of a long T tube After common duct exploration has demonstrated that no obstruction is present at the ampulla, a short armed T tube is placed in the common duct and removed in 8-12 days. If definite fibrosis or stricture is present the long T tube is left in place for at least six months. Forcible dilatation of the ampulla and sphincterotomy are followed by submucosal hemorrhage, edema, fibroblastic proliferation and later fibrosis Theoretically the tube must remain in place until absorption of the scar has occurred and smooth mucosal healing has resulted

Fibrosis of the sphincter or stricture of the papilla were found in 14 men and 35 women, ages 29 73 The symptoms encountered included all those commonly associated with calculi in the biliary tract Jaundice had been present in 27 patients and 32 had had previous cholecystectomy without relief from symptoms, including 6 in whom a common

duct stone had been previously removed At surgery common duct stones were present in 13 at the time the fibrosis was discovered Moderate to pronounced dilatation of the common duct was found in 17 Forcible dilatation of the sphincter was performed in 35 by insertion of a long T tube Transduodenal sphincterotomy was performed in 10, in each of whom a long T tube was utilized. Three had dilatation of the sphincter with implantation of a short T tube, and one had choledochoduodenostomy because subtotal gastrectomy had been done earlier There was no operative mortality Of 37 patients followed for six months or more, 28 had complete relief from symptoms and 6 were improved, 1 was a failure and 2 were dead

Accidental Injuries to Deep Bile Ducts in Cholecystectomy Karl Lehmann[9] (St Lukas Hosp., Copenhagen) reports that among 630 cholecystectomies there were 4 instances of injury to deep bile passages The causes of such injuries are (1) control of profuse and uncontrolled bleeding from the cystic or right hepatic artery by blind application of hemostatic forceps leading to injury of the hepatic duct, (2) excessive pull on the cystic duct to draw the choledochus up into a tip which is then ligated, or ligation of the cystic duct too near the choledochus thereby constricting it, (3) anatomic variations, including absence or extreme shortness of the cystic duct leading to mistaken identification of the choledochus for this duct, and (4) pathoanatomic changes, such as migration of gallstones, and inflammatory processes which may block the common bile duct thereby complicating an orienting survey of the field Most injuries to deep bile structures occur during cholecystectomy

One of the principal prophylactic points is to avoid any severe hemorrhage during surgery It is advisable to begin the operation with isolation and ligation of the cystic artery Should hemorrhage occur, it can always be controlled by compression of the hepatic artery in the ligament by introducing a finger into the foramen of Winslow, after which hemostasis can be effected without any untoward risk. The cystic duct must never be divided until the sur

(9) Acta chir scandinav 105 193 207 1953

geon knows the components of the bile passages exactly Opinion differs as to whether the gallbladder should be removed from the fundus or retrograde from the cystic duct. Retrograde cystectomy is probably preferable as a standard method simply because it necessitates accurate anatomic preparation, but undoubtedly individualization is advisable in difficult cases. Any injury to the deep bile structures that may occur should be remedied before the operation is concluded This is seldom done

Of the various operations devised for the repair of injuries to the deep bile structures, such procedures as simple dilatation or splitting of the stenosis, replacement of the lost bile duct by alloplastic material and implantation of the fully developed biliary fistula into the stomach or duodenum have been abandoned because of poor results The best available treatment is reconstruction of the bile passages by end to-end union Suturing must be accurate, mucosa to-mucosa, with removal of all scarlike tissue and without any constriction of the passage

Formation of a new stenosis is counteracted by the insertion of tubing which is kept in situ for at least three months and often up to a year or more Some patients have had many operations with poor results, it is then extremely difficult to find the ends of the common bile duct, especially the distal end When the two ends of the ducts are laid free, the next difficulty is in suturing It is often necessary to mobilize the duodenum and the lower part of the choledochus carefully as well as divide the head of the pancreas to bring the two ends together Insertion of a T tube is recommended to facilitate drainage, to allow flushing in the event of blockage and to allow the performance of cholangiography Whenever end to-end suture of bile passages is impossible, anastomosis must be done Anastomosis to the duodenum or jejunum must be done on a mucosa to-mucosa basis and secondary stenosis must be prevented by the application of a tube There is always danger of regurgitation through the anastomosis

In three of four cases of injury to deep bile passages, subsequent reparative surgery produced favorable results and in one only a tolerable result

[A ratio of one common duct injury to 150 cholecystectomies seems too high.—Ed.]

Carcinoma of Extrahepatic Bile Ducts W B Fleming[1] (Univ of Melbourne) reports on 60 men and 42 women, most of them aged 60-80, in whom the site of the lesion was the middle and lower segments of the common bile duct in 42, at the junction of the common hepatic duct, common bile duct and cystic duct (triple junction) in 30, in the hepatic ducts in 14, in the ampulla of Vater in 12, in the cystic duct in 2 and diffuse in 2 Macroscopically the tumor was a diffuse infiltrating growth involving long sections of duct in 86, a narrow stricture in 7, a fleshy and fungating growth projecting into the lumen of the duct in 5, it was not described in 4 Carcinoma of the gallbladder was found as a separate entity in four Microscopically there was a wide variation in cell type and degree of differentiation and most tumors were scirrhous Predominant histologic patterns were columnar cell adenocarcinoma 58, papillary adenocarcinoma 15, small duct type 11, spheroidal cell carcinoma 11, columnar cell carcinoma 3, anaplastic carcinoma 3 and unspecified 1

In 51 cases there were lymph node or distant metastases or both in other organs when the diagnosis was first made Lymph node metastases to the nodes around the head of the pancreas, in the porta hepatis the cystic gland and upper preaortic group were found in 33 Blood spread to the liver occurred in 25 to the lung in 10 and to the adrenal glands in 2 Direct invasion of the liver was found in 26 of 44 carcinomas of the hepatic duct and triple junction regions The gallbladder was distended in 49 cases and had been removed previously in 8 It was not enlarged in any case of hepatic duct carcinoma and in only 9 of 30 cases of triple junction region carcinoma The gallbladder was enlarged in 28 of 42 cases of carcinoma of the common bile duct and in 10 of 12 ampullary carcinomas Gallstones were present in 38 patients and a cholecystectomy for cholelithiasis had been performed in 8 more Gallstones were found in one quarter of the males and in three quarters of the females The highest incidence of gallstones was found in association

(1) Australian & New Zealand J Surg 23 148 155 November 1953

with carcinoma at the triple junction. Stones were present in the common bile duct in seven cases

The symptoms at onset of the disease in order of decreasing frequency were pain apart from colic, obstructive jaundice, malaise, biliary colic, nausea and vomiting, loss of weight, flatulent dyspepsia, anorexia, fever and pruritus. It was difficult to determine the duration of the disease because often the symptoms were due to the associated gallstones Of 73 patients subjected to laparotomy, 9 had resection of the carcinoma, 49 had some form of palliative surgery and no definite surgery was done in 15 Death occurred within two weeks of surgery in 29 For 26 patients who died without operation, the average duration of illness from the onset of jaundice until death was nine weeks Excluding patients with very long histories, the time from onset to diagnosis in 81 patients was nine weeks

Carcinomas of the biliary tract close to the gallbladder are more commonly related to gallstones than those further from the gallbladder The diagnosis of extrahepatic bile duct carcinoma is not easy to make even at the operation and the tumors are difficult to treat. Most cases are too advanced for cure when first discovered.

[In 1930 the editor gave a lecture in Melbourne on carcinoma of the gallbladder and he was told that the condition was practically unknown there. Evidently changes have occurred.—Ed.]

Benign Tumors of Ampulla of Vater Comparison of Survival Following Local Resection of Benign and Malignant Ampullary Tumors Andrew Kirsteins, Michael C Govostis and John van Prohaska[2] (Chicago) state that ampullary tumors are rarely diagnosed preoperatively In three patients with ampullary tumors, exploration revealed a distended gallbladder and common duct In two patients the tumor was palpable through the duodenal wall, in the third patient the tumor was not found until the duodenum was opened and the ampulla brought into view A duodenotomy should be performed in instances of negative exploratory findings in patients with obstructive jaundice All ampullary tumors should be studied by biopsy to determine if they are benign or malignant. Local transduodenal resection

(2) A M A Arch. Surg. 67 708 714 November 1953

with transplantation of the common and pancreatic ducts appears to be an adequate operation for a benign tumor of the ampulla One patient with a benign intraductile papilloma survived 13 years after local resection of the tumor Two patients with carcinoma of the ampulla survived 11 and 4½ years after local resection of the tumor and died of metastases It is possible that the patients with carcinoma might have survived longer if they had had a pancreatoduodenectomy

Physiologic Studies in Cases of Stricture of Common Bile Duct 28 Year Survey with Data on 254 Patients Waltman Walters[3] (Mayo Clinic) states that 297 operative procedures were performed on these patients between 1924 and 1951 Patients operated on during 1924-39 and 1940-47 were compared with 100 patients (113 operations) who had operations during 1948-51 The operations used, in order of frequency, were hepaticoduodenostomy choledochoduodenostomy and choledochocholedocostomy

Results with choledochoduodenostomy were excellent in 71% for 1924-47, and 82% for 1948-51 There has been a progressive increase from 11 to 18 to 27% in the number of duct to-duct anastomoses after incision of the stricture in the three periods Only 56% of patients in the earlier series derived excellent results from duct to-duct anastomoses compared with 71% in the recent series Since 1939, hepaticoduodenostomy has been used more often because of the greater extent of the strictures Excellent results were obtained in 53% in the 1948-51 group This percentage of excellent results in contrast to the better results from choledochoduodenostomy is due to the short length of hepatic duct available for anastomosis to the intestine and the degree of liver damage due to infection and intrahepatic formation of stone resulting from more nearly complete stricture of the ducts

All patients with recurring strictures of the common bile ducts regardless of the number of previous operations, are entitled to re-exploration unless contraindicated by severe liver damage and poor physical condition This is rarely the case During surgery dissection should be continued un

(3) Ann. Surg 138 609-617 October 1953

til either the ends or the upper unobstructed portion of the duct is found, even though it necessitates intrahepatic exploration and drainage In the last series it was possible to make ductal or ductal intestinal anastomosis in 90% of the cases and to relieve the biliary obstruction by external hepaticostomy in the other 10% The hospital mortality in the first series was 10.2%, in the second 3 0% and in the last 7 1%

Best results have been obtained when prosthetic devices are used to splint the anastomosis for at least nine months. When intrahepatic infection is severe, the T tube is the most satisfactory splint, especially when there has been formation of stones in the intrahepatic duct. Otherwise an indwelling catheter, extending through the sphincter of Oddi, is used to splint the duct to-duct anastomosis Bile pigment accumulates in the lumen and around the sides of all prosthetic devices placed within the common bile duct and produces obstruction. Therefore, such tubes must be removed, preferably without reoperation

[This is a good article, full of useful and practical information, but the title is somewhat misleading to anybody who expects much physiologic information.—Ed.]

THE PANCREAS

Choledochoenterostomy in Chronic Relapsing Pancreatitis Louis M Rousselot Rafael Sanchez Ubeda and Stanley Giannelli[4] (St Vincent's Hosp, New York City) report five cases in which choledochojejunostomy was done with Bowers' technic cholecystectomy had been done previously in four and at the same time in one All patients were thought to have chronic relapsing pancreatitis before surgery but only three showed this on gross or microscopic examination or both In one case the pancreas was normal grossly and in one it was normal grossly and microscopically All patients were followed for 24-36 months and only the patient with a normal pancreas both grossly and microscopically did well. Although she had symptoms of

(4) New England J Med 250 267 272 Feb. 18 1954

chronic pancreatitis, cholesterosis of the gallbladder was found

This is the first known report of unsatisfactory results after choledochoenterostomy These results suggest that separation of pancreatic and biliary flow does not always cure chronic relapsing pancreatitis This conclusion is at variance with the experience from other clinics However, in many cases reported in the literature in which the operation has been successful there is some doubt concerning the diagnosis of chronic relapsing pancreatitis Diagnosis can be made only if there is a history of repeated bouts of abdominal pain, accompanied by significant spontaneous elevation of amylase and lipase content in the urine or serum or both One episode of pancreatitis does not lead to chronic relapsing pancreatitis Pancreatitis must be demonstrated by fat necrosis, edema of the gland, cyst formation and microscopic evidence of acute and chronic inflammation. The following manifestations will aid in diagnosis even in the absence of elevated serum enzyme content: alteration in carbohydrate metabolism or fat digestion, demonstration of pancreatic calcification on x ray study and repeated and significantly low, pancreatic secretion, as demonstrated by duodenal drainage Some cases of pancreatitis can exist without most of these overt manifestations Pancreatitis can be confused with many other gastrointestinal diseases and erroneous conclusions drawn after surgery

The failure of operations dividing biliary and pancreatic flows is suggestive evidence against the common channel theory of operating in all cases of pancreatitis

Recurring Pancreatitis and Associated Stenosis of Common Bile Duct Treatment by Roux-Y Choledochojejunostomy According to Frank F Allbritten, Jr[5] (Jefferson Med College), early, recurrent pancreatitis may be treated by division of the sphincter of Oddi unless the disease has progressed to extensive fibrotic changes causing extraluminal obstruction of the intrapancreatic portion of the common bile duct In such cases, it is necessary to anastomose the biliary tree to a defunctionalized limb of the

(5) A M A Arch Surg 67 779 789 December 1953

junum on the hepatic side of the obstruction both to relieve symptoms of pancreatitis and stop the progress of the disease

In five patients, stenosing pancreatitis had obstructed the common duct above the sphincter of Oddi, producing obstructive jaundice In the first patient, end to-end choledochojejunostomy and pancreatic ductojejunal anastomosis functioned well and relieved the symptoms of recurrent pancreatitis In the second patient, end to-side choledochojejunostomy, with a Roux Y jejunojejunostomy functioned well and prevented further symptoms In the third patient, anastomosis of the fundus of the gallbladder to the end of a defunctionalized limb of jejunum and a Roux Y jejunojejunostomy functioned well The fourth patient had carcinoma of the pancreas initially a loop cholecystojejunostomy without proximal jejunojejunostomy was replaced, after symptoms recurred a year later by choledochojejunostomy with Roux Y jejunojejunostomy and the gallbladder was removed he later died of carcinoma The fifth patient, treated by end to-end choledochojejunostomy with end-to-side Roux Y jejunojejunostomy and cholecystectomy, was symptom free

Although the results have been good more time will be necessary because of the recurrent nature of the disease before full evaluation of the procedures

[Compare these results with those of Rousselot *et al.* in the preceding article.—Ed.]

Acute Pancreatitis Fate of Patient Surviving One or More Acute Attacks John W Baker and Marshall K. Bartlett[6] report that of 134 patients with acute pancreatitis seen at the Massachusetts General Hospital between 1946 and 1951, 16 (12%) died. This mortality rate compares favorably with the 18% for 1937-41 the 31% for 1942-44 and the 12% for 1945-47 None of the 118 survivors aged 27 86, died post operatively Of the 42 patients given no definitive treatment after recovery from the acute attack, 16 had had no, 13 had had from one to five and 13 had more than five earlier attacks. Cholecystectomy had been performed earlier on five patients and two had had cholecystostomy during the

(6) New England J Med, 249 751 757 Nov 5 1953

acute attack Of 32 patients traced for 12 60 months after the attack, 22 had had no further similar attacks, 4 had had vague upper abdominal symptoms and in 6 the symptoms were recurrent The poor results corresponded roughly to the greater number of preceding attacks

In 59 patients cholecystectomy and choledochostomy were performed at varying intervals after the onset of the acute attack The common duct was explored by passage of graduated Bakes dilators into the duodenum, in the 51 traced for 12 72 months, 47 had good, 2 had fair and 2 had poor results Of 35 patients with more than five previous attacks, 28 were traced, 26 had good and 2 had fair results Several weeks were usually allowed to elapse between the acute attack and the operation. Most patients had stones in the gallbladder, the common duct, or both. Only in two patients with poor results was patency of the ampulla never established

Over all results indicate that primary, definitive surgery for recurrent pancreatitis should be aimed at the biliary tree, the surgical results are better in early pancreatitis without than in chronic pancreatitis with calcification, and early operation may prevent serious late manifestations of recurrent pancreatitis

Experimental Production of Chronic Pancreatitis by Section of the Pancreatic Sphincter Although chronic relapsing pancreatitis is sometimes attributed to hypertonicity of the sphincter of Oddi, hypotonicity of that sphincter, and especially of Wirsung's duct is not generally incriminated P Mallet Guy, J Feroldi, M Gangolphe and Colin[7] (Grenoble, France) were able to produce lesions similar to those of chronic pancreatitis in the dog by severing the pancreatic duct at its duodenal opening, thereby creating atony Although the results in 24 of the 57 dogs studied were of no direct value, either because of premature death or because autopsy indicated inadequate section of the sphincter, they helped to prove that mere manipulation of the pancreas failed to produce lesions characteristic of abolished sphincter function Repeated studies and biopsies among the other 33 dogs disclosed that 11 had chronic in

( ) Lyon chir 48:419-446 May-June 1953

flammatory, predominantly pericanalicular, pancreatic lesions closely resembling those found in patients with pancreatitis Examination of the 22 animals with the pancreas apparently intact disclosed the histologic changes in glandular structure which, again, resembled those discernible in patients with pancreatic disease The vasomotor disturbances resulting from these chronic inflammatory lesions may well be responsible for the various acute, edematous or necrotic processes that affect the pancreas The syndrome of relapsing pancreatitis in particular is probably often superimposed on the chronic disease produced by atony of the sphincter of Oddi

Annular Pancreas is congenital in origin, probably formed by adherence of part of the right ventral pancreatic anlage to the duodenum during its rotation. Signs and symptoms are those of partial obstruction of the second portion of the duodenum often beginning in adult life the initiating factor being the development of pancreatitis with contraction of the ring

According to Lee Gillette and Brock Lynch[8] (New York City), by pass operations are preferable to direct attack on the ring thus avoiding danger of fistula formation. Duodenojejunostomy is preferred to gastrojejunostomy, as it decompresses the doudenum directly, avoids a "blind loop" and allows examination of the duodenum from within. Of 24 patients, 15 were treated by by pass procedures, with 86 8% good results 9 were treated by direct methods, with 11.1% good results and persistent obstruction or fistula formation in 66%

Man, 64 had had nausea after every meal for 1½ years, with vomiting as often as twice a week, always between 9 p.m. and midnight, irrespective of type of food. For three months before operation there were bloating and belching after eating Serum amylase levels were 195 and 187 Somogyi units. Gastrointestinal study of the midportion of the descending limb of the duodenum showed moderate constant extrinsic pressure defect arising from the right posterolateral aspect of the duodenal loop The barium bolus passed this point with extreme difficulty, although the stomach was empty after four hours. Diagnosis was annular pancreas. Operation revealed a completely encircling annular pancreas, with markedly dilated duodenal bulb The pancreas was firm and nodular Opening

(8) Ann Surg. 139 374 378 March, 1954

of the first portion of the duodenum permitted palpation of the lumen, which was narrowed and admitted only the tip of the index finger A duodenojejunostomy was performed 12 inches beyond the ligament of Treitz. In the first six weeks after operation, he had three episodes of vomiting but remained asymptomatic thereafter

Annular Pancreas A J Tomsykoski, Richard C Stevens and Patrick A. Izzo[9] (Binghamton, N Y) present one case of annular pancreas in which the preoperative diagnosis was duodenal diverticulum It is the fifth case on record in which gastric resection gave successful results and the second in which the pancreatic ring was divided concomitantly

Woman 50 for 18 months had had anorexia, indigestion and infrequent bouts of vomiting and had lost 18 lb There was slight tenderness to pressure in the right upper quadrant. Barium studies disclosed a large pouch arising from the postbulbar area and appearing to represent a large duodenal diverticulum at the junction of the first and second portions. The duodenal sweep was interpreted as normal. The duodenal bulb was not well visualized and appeared to be overlapped by a large diverticulum There was a large recess on the greater curvature side of the base of the duodenal bulb However, a few films showed a line of cleavage that confirmed the impression that there was a large diverticulum immediately behind the bulb Exploratory laparotomy disclosed a normal duodenal cap, but just below the duodenal arch the passage was dilated to at least three times its normal diameter mainly on the medial aspect Exploration below the dilatation disclosed an anomalous band of pancreatic tissue completely encircling the second part of the duodenum in its midportion The rest of the pancreas looked normal. Cholecystectomy and a Polya type gastric resection were performed and the anomalous band on the anterior surface of the duodenum was divided The postoperative course was uneventful and she was still completely symptom free after 16 months.

[Why the cholecystectomy?—Ed.]

Fibrocystic Disease of Pancreas Surgical Aspects (Meconium Ileus) According to J Bréhant[1] (Algiers), the essential anatomic physiologic, and clinical characteristics of fibrocystic disease of the pancreas are (1) sclerocystic transformation of digestive and respiratory mucus secreting glands (2) abnormal viscosity of mucous secretions, and (3) sometimes serious, often irreversible conditions attributable to the secretory disturbances ranging from

(9) Am. J Surg 86 60-63 September 1953
(1) Presse méd. 61 16 7 16 9 Dec. 9 1953

intestinal occlusion requiring surgery in the newborn to simple nutritional deficiency or mild bronchopulmonary complications in children who survive When the intestinal tract is involved, the condition is commonly referred to as meconium ileus However, meconium ileus often results from congenital malformation of the small intestine. Although the pathogenesis of fibrocystic disease of the pancreas has never been satisfactorily explained, it is often associated with other malformations and its hereditary character is generally accepted.

In acute neonatal meconium ileus, which requires surgical treatment, congenital occlusion of the lower part of the small intestine gives rise to the well known triad of vomiting abdominal distention and failure to expel meconium Prognosis is usually poor even if the infant survives the operation, relief is transitory and he dies of pancreatic insufficiency or respiratory complications Less pronounced symptoms however may be found in older children with relatively milder lesions, for these the outlook is somewhat better

Efforts should be made during the first few hours to induce peristalsis by administration of neostigmine or repeated small hypertonic enemas If these measures fail, operation must be undertaken promptly Preoperative care includes warming and rehydrating the patients, who are often exhausted. General anesthesia should be induced with ether oxygen mixture with apparatus specially designed for infants followed by local anesthesia of the abdominal wall with procaine 1 200 The abdomen should then be explored through a median incision to establish diagnosis and determine the nature and extent of associated lesions Evacuation of the thickened meconium may prove impossible, necessitating resection of the obstructed loops Enterotomy is valueless, and removal of the meconium by this method should not be attempted Intraileal injections of solutions designed to dissolve intestinal contents, especially hypertonic sodium chloride and pancreatin, sometimes prove beneficial, the author suggests that they might be given advantageously as needed through an indwelling catheter following minimal ileostomy

Infants operated on for meconium ileus require constant postoperative supervision by trained personnel capable of instituting continuous duodenal or tracheal aspiration for removal of bronchial secretions. An oxygen tent is essential and the infant must be kept warm and properly hydrated, in an incubator if necessary. Feeding should be resumed gradually, with sugared water on the first day, followed by mother's milk. Feeding should be accompanied by oral administration of pancreatic extracts.

Studies on Pancreatitis. Eric G. Saint and Sara Weiden[2] (Royal Melbourne Hosp.), studied nine males and two females with acute pancreatitis, of whom two died. The most frequent presenting symptoms were persistent vomiting and pain in the epigastrium which radiated to the right and left hypochondrium and through to the back at the level of the 12th dorsal to 2d lumbar vertebrae. Duration and degree of abdominal pain and tenderness were variable. Five patients had obstructive jaundice and two transient glycosuria. Urinary diastase level was elevated for a few days after onset of pain in six patients who had the test. In three, acute pancreatitis was associated with cholelithiasis, in five with heavy alcoholism and in two with infections such as mumps and infectious hepatitis. Diagnosis of acute pancreatitis is often difficult. Treatment consists of relief from pain with pethidine, continuous gastric aspiration, fluids intravenously and penicillin. If there is evidence of cholelithiasis, elective cholecystectomy should be performed after the attack of acute pancreatitis has subsided.

A study was made of 5 males and 10 females with chronic pancreatitis. Of four males with chronic relapsing pancreatitis, three had essential hypertension and three were heavy consumers of alcohol. All had recurring episodes of upper abdominal pain and evidence of deficiency of either internal or external pancreatic secretion, such as glycosuria and hyperglycemic sugar tolerance, frank steatorrhea, wasting or a low flat type of gelatin absorption. Some had elevated urinary diastase levels during attacks of pain and some had calcification of the pancreas. Liver biopsy in one showed fatty changes. During treatment of chronic relaps

(2) Brit. M. J. 2: 1335-1340, Dec. 19, 1953.

ing pancreatitis the diet should be improved and strict abstinence from alcohol enforced. Three patients had temporary relief from pain after bilateral splanchnic block.

Eight women had relapsing pancreatitis following cholecystectomy for gallstones. In some, pain followed ingestion of a fatty meal. This type of relapsing "reflux" pancreatitis is difficult to treat, and further data on the mechanics of the sphincter of Oddi and the common bile duct are required before surgery can be planned. Three patients had chronic pancreatitis due to either ulcerative colitis, nutritional or infectious hepatitis The intravenous secretin test was not of much value in diagnosis of either acute or chronic pancreatitis

More attention should be paid to the etiologic aspects of pancreatitis The following entities can be differentiated (1) traumatic pancreatitis, following stomach and duodenal surgery, (2) virus pancreatitis, complicating mumps and infectious hepatitis, (3) reflux pancreatitis, complicating biliary calculi and following cholecystectomy, (4) chronic nutritional pancreatitis or "chronic relapsing pancreatitis," occurring in malnourished alcoholics, and (5) metabolic pancreatitis complicating hyperlipemia and hypercholesteremia

Intraductal Secretory Pressure of Pancreas in Unanesthetized Dogs. According to John H. Wulsin and Vinton E Siler[3] (Univ of Cincinnati), the mechanism of intraductal secretory pressure of the pancreas is not well known Of the few reports on pressure in the pancreatic ducts, all but that of Harms were based on measurements performed in anesthetized animals However, this report is concerned with the details of creating and managing external pancreatic fistula in dogs and with daily observations of pancreatic pressure measured in unanesthetized dogs. A fistula was created by exteriorizing the main duct to the anterior abdominal wall intraductal pressure was measured by insertion of a properly fitting glass cannula into the orifice of the fistula and allowing the secretion to mount in a vertical glass manometer The height in millimeters was noted in relation to minutes of observation

(3) Surgery 34 1 10 July 1953

Secretory pressure curves followed S shaped patterns After the beginning of a measurement the intraductal pancreatic pressure as a rule rose slowly during the first 10-15 minutes, it climbed steeply during the next 20-30 minutes until it reached the peak where after a slight fall, it remained on a plateau for the rest of the reading Maximal daily pressures varied but averaged about 450 mm of secretion They tended to rise as the postoperative course lengthened In one animal, after the third postoperative week, maximal pressures usually stayed above 500 mm. The peak was 825 mm., reached on the 38th postoperative day Such maximal secretory pressures obtained in fully relaxed animals under controlled conditions far exceed previously reported values

Pancreatic secretory pressure measured at an external fistula may be considered the result of two intraglandular processes, secretion and resorption The acinar cells of the parenchyma and the mucinous cells of the duct system secrete against pressures In the presence of an obstruction of the pancreatic duct system, such as that imposed during the measurement of intraductal pressure, it may be assumed that secretion is being resorbed at varying rates through the epithelium of the duct into blood and lymphatic channels When more liquid is secreted than resorbed, the secretory pressure rises, when the rate of both processes is equal secretory pressure remains constant Finally, a fall in pressure indicates greater resorption than secretion.

Before the glass cannula is inserted into the fistula, the pancreas secretes at low physiologic pressures and resorption is at its lowest level, possibly nonexistent After the fistula has been cannulated (obstructed), the duct system fills and distends until there is enough pressure to cause a rise in the manometer A period of lag is represented by the relatively flat lower portion of the pressure curve The steep middle part of the curve signifies continued secretion into a fully distended duct system The final flattening at the top of the curve suggests that resorption of fluid increases and then equals the rate of secretion.

The double process of secretion and resorption may in large part account for the variation in maximal daily pres-

sure and in secretory rates The gradual rise in maximal daily secretory pressure after formation of the fistula may be interpreted as the result of decreasing resorption of secretion in the presence of increasing fibrosis of the pan creas In these experiments no correlation existed between the rate of secretion and maximal secretory pressure

The effect on secretory pressure of such pancreatic stimu lants as food or of such inhibitors as atropine is not espe cially striking This is true because changes in secretory rates at high intraductal pressures are buffered by the proc ess of resorption, whereas at normal pressures the changes would be significant

Some Problems in Operative Treatment of Hyperinsulin ism. Johan Holst[4] (Rikshosp, Oslo) considers hyperin sulinism without islet cell tumor extremely rare In four of seven patients operated on for functioning insuloma re sponsible for grave hypoglycemia, the insuloma was visible on the surface of the pancreas or easily palpable in the interior of the cauda and was easily removed at the first operation which cured the hypoglycemia In the other three, the insuloma was neither visible nor palpable and was missed at the first operation, these cases were misinter preted as hyperinsulinism without islet tumor, and sub-total resection (removal of the body and the tail) was per formed This operation had no effect on hypoglycemia. No insuloma was found in the resected specimens. At a second operation for revision, explorative transections of the head disclosed insulomas deep in the parenchyma of the head in all three cases After removal of the insulomas, two patients were cured. In the third hypoglycemia persisted probably because of incomplete removal (enucleation) of the two insulomas found or because more insulomas were present

If no insuloma is found on explorative inspection and palpation in the patient with hyperinsulism explorative transections should be done at the same or at a later stage Evidence points to the ineffectiveness of subtotal pancrea tectomy in hyperinsulinism if no insuloma is found in parts removed Among surgical principles to be followed in op

(4) Acta chir scandinav 105:138 143 1953

eration for hyperinsulinism are adequate exposure, the head of the pancreas is best exposed by a right rectus incision and the body and tail by transverse incision Exploration of the pancreas should be by inspection, palpation and, if necessary, with transections through the tail and body, starting at the tail. If these procedures fail to disclose in suloma it is probably localized in the head which has to be explored by mobilization and transections Considering the dangers involved in explorative transection, it hardly seems rational to perform such transections in search of multiple insulomas if one insuloma has been found. The tumors should be removed by resection of that part of the pancreas which contains them with at least a fringe of nor mal pancreatic tissue around the tumor Enucleation of insulomas should be discouraged. Clinical experience seems to suggest some discrepancy between the histologic picture and the biologic potentials of insulomas

[This statement by the late Johan Holst that hyperinsulinism without islet cell tumor is extremely rare is certainly true but exceptional cases have been reported in which subtotal pancreatectomy has relieved the hypoglycemia although no tumor has been found in dissection of the removed specimen. I had such a case.—Ed]

THE ESOPHAGUS

Muscle Wall Tumors of Esophagus Richard H Sweet, Lamar Soutter and Carlos Tejada Valenzuela[5] (Boston) group esophageal tumors according to the layers in which they arise carcinomas and certain polyps arise primarily from the mucosa cysts, certain sarcomas pedunculated fibromyxomas and lipomas grow in the submucosa, and leiomyomas, neurofibromas, fibromas, fibromyomas leiomyosarcomas fibrosarcomas and rhabdomyosarcomas originate in the muscularis

The benign muscle wall tumors are difficult to distinguish from one another clinically and microscopically, unless special muscle stains are used All are firm and well circumscribed and ulceration is rare Of 20 benign tumors, 17 were

(5) J Thoracic Surg. 13-35 January 1954

leiomyomas, 2 neurofibromas and 1 fibromyoma. The tumor was single in 16 instances As most benign muscle wall tumors remain beneath the muscle, size is the most important single factor in the production of symptoms Large extra

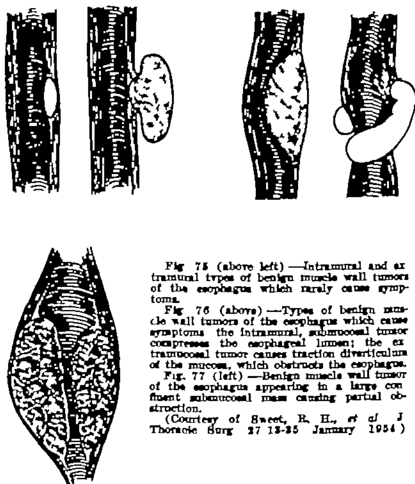


Fig 75 (above left) —Intramural and extramural types of benign muscle wall tumors of the esophagus which rarely cause symptoms.

Fig 76 (above) —Types of benign muscle wall tumors of the esophagus which cause symptoms the intramural, submucosal tumor compresses the esophageal lumen; the extramucosal tumor causes traction diverticulum of the mucosa, which obstructs the esophagus.

Fig. 77 (left) —Benign muscle wall tumor of the esophagus appearing in a large confluent submucosal mass causing partial obstruction.

(Courtesy of Sweet, R. H., et al J Thoracic Surg 27 13-35 January 1954)

mural tumors which lie free and do not impinge on surrounding organs can be asymptomatic (Figs 75 77) Traction diverticula may be associated with extramural tumors.

Muscle wall sarcomas in contrast to those arising in the mucosa and submucosa, grow slowly and have a low incidence of local and distant metastases The authors report one leiomyosarcoma which had ulcerated and metastasized to regional nodes and one rhabdomyosarcoma which had not metastasized

The true incidence of benign muscle wall tumors is un

known. Sarcomas of the muscle wall are extremely rare Both benign tumors and sarcomas are found most frequently in the lower esophagus There is little difference in sex incidence of benign muscle wall tumors Of 11 cases of malignant muscle wall tumor diagnosed in recent years, 7 were in men and 4 in women Average age of patients with sarcoma and with carcinoma is the same, patients with benign tumors tend to be somewhat younger

Symptoms associated with benign tumors are pain, dysphagia and digestive complaints One patient had massive hemorrhage The symptoms of muscle wall sarcoma closely parallel those of squamous cell carcinoma except that pain is common with sarcoma. Marked weight loss, inconsistent with degree of esophageal obstruction, is another outstanding symptom. Dysphagia is the principal symptom. Regurgitation, salivation, anemia and tarry stools also occur

Roentgenographically, after a swallow of barium, smooth continuity of the mucosa in the region of the growth helps to distinguish the extramucosal lesions from destructive growths involving the epithelial layer Though esophagoscopy may help to rule out carcinoma by identification of an intact mucosa, endoscopic biopsy through intact mucosa is seldom helpful, it is potentially dangerous and renders subsequent enucleation without contamination impossible When symptoms and x ray studies are indicative of muscle wall sarcoma, endoscopic biopsy is the best means of establishing a preoperative diagnosis

Simple enucleation is the treatment of choice for benign tumors and was performed on seven patients in this study Excision of tumors with small segments of mucosa was successful in two patients Resection was performed on two patients, with satisfactory results. Although experience with treatment of sarcomas is small, surgical resection seems to be the choice for both diffuse and polypoid types. Palliative surgery is justifiable and there is some promise that polypoid sarcomas arising in the muscularis can be cured in a high percentage of cases, as they grow and metastasize slowly

Benign Tumors and Cysts of Esophagus R S Totten, A. P Stout, G H Humphreys and R L Moore[6] (New York

(6) J Thoracic Surg 25 606-6 2 June 1953

City) present data collected from reports of 163 cases. Of the gastrointestinal symptoms, the commonest was dysphagia. In only two cases did significant hemorrhage occur Diagnosis was established by barium swallow, esophagoscopy and exploration. Most of the polypoid tumors were treated via the esophageal lumen, a few by esophagotomy The intramural growths were treated by enucleation for the most part and in some instances by resection of the esophagus or a combination of the two The large tumors and those cresentic or annular in shape generally required resection of part of the esophagus No cysts required resection.

Approximately one third of the patients with polypoid tumors died as a direct or indirect result of the tumor, and most of these were incorrectly diagnosed

Benign tumors may be divided into intraluminal and intramural Most of the former are fibrous polyps, although polypoid lipomas and leiomyomas occur The majority are attached in the region of the cricoid cartilage Sessile intraluminal growths while seen are rarely of clinical significance The solid intramural tumors are predominantly leiomyomas and may be found at any level. The intramural cysts are congenital and usually contain derivatives of the primitive foregut Most of them occur in the middle or lower thirds of the esophagus Supernumerary tissues, other than gastric epithelium rarely appear in the esophagus and inflammatory conditions are not common

Malignant polypoid and intramural tumors occur which clinically can mimic the benign growths If an accurate diagnosis is made and proper therapy employed a good prognosis may be expected

Question of Cardiospasm and Achalasia Alfred Haas[7] (New York City) discusses the complexity of the problem and the difficulty in restoring normal function.

Case 1—Woman 56 had had difficulty in swallowing food for one year and had lost 8 lb Psychiatric treatment had failed to relieve symptoms. X rays revealed slight dilatation of the esophagus with long drawn-out constriction of the cardia Evidence of duodenal ulcer also was noted. Mechanical dilatation produced only transient relief On the premise that recurrence of cardiospasm was a reflex

(7) Am. J Surg 87 567 577 April 1954

spasm from the duodenal ulcer, an extensive Polya Hofmeister gastric resection was carried out. Improvement lasted two months Further dilatation was refused Through an abdominal approach, the esophagus was brought down from the chest about 3 in Only a ring at the cardia was hypertrophic, the esophagus was narrow and paper thin The lowest part of the esophagus and the hypertrophic ring were cut and the longitudinal incision closed circumferentially No further dysphagia was noted but she complained of lassitude, some pyrosis and loss of appetite. Despite x ray evidence of good communication there was occasional reflux of gastric contents

CASE 2—Man, 51, had chronic respiratory ailments He developed intermittent dysphagia followed by a painful, cramplike sensation behind the ensiform process X ray showed esophageal dilatation. Transient improvement after mechanical dilatation was followed by aggravation of symptoms. Exploration through a left costal arch incision revealed a thickened, tortuous esophagus. Anastomosis was made between the whole lower esophagus and fundus. The cardia was completely cut to avoid spur formation He gained weight rapidly and had no further symptoms.

This condition usually starts insidiously, and methods are devised by the patient to force food into the stomach by taking increasing amounts of fluids or attempting a modified Valsalva maneuver When the patient is in the horizontal position coughing and choking attacks often occur With increasing esophageal dilatation, encroachment on the mediastinal structures is encountered.

Diagnosis is based on x ray study and esophagoscopy, with differentiation from hiatus hernia diverticulum, carcinoma reflex cardiospasm biliary and coronary artery disease and neurosis Mechanical dilatation meets with success in about 80% of cases Patients who need surgery may be treated by the Heller Groendahl or Wangensteen procedures transthoracic or abdominal according to individual needs

Evaluation of Treatment of Cardiospasm by Dilatation and Operation Tyge Cl. Gertz, H K. Kristensen and Gregers Thomsen[8] (Rigshosp., Copenhagen) compare functional and roentgenologic results of conservative and operative treatment of cardiospasm Dilatation of the cardiospasm by Starck's method was performed in 1932 50 in 38 patients practically all of whom had diagnostic esophagoscopy before dilatation The effect of the treatment was striking

(8) Acta chir scandinav 105 113 121 1953

and immediate after a single dilatation in 22 patients. In 11 patients the treatment had to be repeated a second time, and in 5 others two to four times, for the desired effect One patient, with perforation of the stomach due to dilatation, recovered after surgery At follow up an average of six years later, the functional results were good in 15 patients, improved in 9 and unchanged or bad in 8, 5 had died of other causes, and 1 could not be followed. Distinct resistance to the dilator during treatment was found to be almost a precondition of a good result

Between 1946 and 1950, 24 operations were performed on 22 patients 2 of whom were operated on twice The Backer Grøndahl operation was performed five times, the Wendel operation twice Resection of the cardia with esophagogastrostomy end to-side was performed once and Heller's cardiomyotomy 14 times In the two who had second operations, Wendel's and Heller's methods were each used once The transthoracic approach was used in all Heller operations but one, in which a laparotomy approach was used. One patient died of empyema after the operation another due to rupture of the anastomosis Follow up of the five patients operated on by the Backer Grøndahl method showed that two required reoperation because of poor results, of the other three, two had satisfactory and one had only fair results One of the two patients who had the Wendel operation died whereas the other had a good functional result Among the 14 patients who had Heller's cardiomyotomy the functional result was good in 10 improved in 1 and not improved in 1, 2 patients could not be followed. There seemed to be no correlation between functional and roentgenologic results The functional and roentgenologic results were better in the group treated surgically than in those who had Starck dilatation

The roentgenologic result reveals no parallelism between the severity of the condition on roentgen examination and the functional results after both forms of treatment. Yet patients treated surgically become roentgenologically normal more often than those treated with dilatation.

The authors conclude that primarily cardiospasm should

be treated conservatively and, if this fails, Heller's transthoracic cardiomyotomy should follow

[Most surgeons who have had a fairly extensive experience with this condition will agree with the authors conclusions. One reason for an unsatisfactory result after the Heller operation is that the surgeon has not performed a sufficiently extensive operation The incision in the muscle should be at least 3 in. long and it should go well down on the stomach.—Ed.]

Esophageal Diverticula. Frank H Lahey and Kenneth W Warren[9] (Boston) operated on 365 patients with pharyngoesophageal pulsion diverticula and on 9 with epiphrenic pulsion diverticula Results of follow up on the first 250 with pharyngoesophageal diverticula are presented.

In the triangular area at the pharyngoesophageal junction a weak spot the pharyngeal dimple, bulges to form the first stage of a diverticulum when undue pressure results from in-co-ordination in swallowing A diverticulum is produced after repeated obstruction, the sac attaining greater proportions by weight of contents and repeated distention. It enlarges in the only unobstructed pathway—downward and into the mediastinum.

In the first stage, the only symptom is a feeling of a foreign body lodged at the bulging point, producing attempts to dislodge it by hawking Surgery should be postponed until a definite sac with a definite neck is formed. In the second stage with sac developed, the opening is still laterally placed and symptoms are related to accumulations within the sac not to esophageal obstruction In the third stage the contents of the sac cause descent of the diverticulum to such an extent that the true opening into the distal esophagus is converted into a lateral slit, and food cannot enter the esophagus

Diagnosis almost entirely depends on x ray demonstration after a swallow of thin barium mixtures A semilateral view is necessary to prove spillover from the diverticulum into the esophagus Bouginage is dangerous particularly in the second and third stages

Choice of one or two stage operation should be based on mortality morbidity and recurrence rates of both operations With the two stage attack, there were two deaths

(9) Surg., Gynec & Obst 58 1-8 January 1934

in 365 operations, and 12 recurrences (4 8%) in 250 followed at least 2½ years There were no persisting sinuses, and in all except the 12 with recurrences, swallowing was normal and relief complete One stage procedures require approximately the same time as the two stage procedure.

TECHNIC.—A long, longitudinal oblique incision in front of the sternocleidomastoid muscle provides adequate exposure The anterior belly of the omohyoid is clamped, cut and removed Dissection is carried well up to the attachment of the omohyoid to the hyoid bone, exposing the outer edge of the thyrohyoid. The internal jugular is thus exposed and its branches to the thyroid are cut, allowing the outer edge of the thyroid to be lifted from its bed The common carotid and internal jugular are pulled back, and the inferior thyroid artery ligated and cut, exposing the region of the pharyngoesophageal diverticulum The sac is picked up, the junction with the esophagus demonstrated and the sac dissected free. The muscle fibers of the cricopharyngei must be dissected off the neck of the sac to expose the pale white submucosa of the mucous membrane so that at the second stage the neck can be accurately tied flush with the esophagus. The muscle fibers of the posterior and right side of the neck of the sac are dissected at the second stage. Around the tip of the sac are tied two black silk sutures attaching it to the outer edge of the sternohyoid wall above the entrance of the neck of the sac into the esophagus. No needles are passed through the sac. The wound is closed over a cigaret drain

After seven days the wound is parted and the previous line of separation found. The sac is located and the remaining cricopharyngeal fibers are severed and wiped back. A no 0 chromic catgut ligature is placed around the neck of the sac against the esophagus. The neck is cut off ¼ ⅜ in. from the ligature, and the cuff of ligated mucosa pushed back under the esophagus to its origin A cigaret drain is used for four days The patient is fed through a Levin tube for seven days. Feeding through a Levin tube between stages is valuable in improving the condition of some patients.

Complications include difficulty from adherent pleura, adhesions to the sac in recurrent diverticula and injury to the recurrent laryngeal nerve

Epiphrenic pulsion diverticula are treated by resection of the sac and inversion of the neck or resection of involved esophagus when obstruction of the esophagus has occurred. Traction diverticula rarely require surgery and are treated satisfactorily by dilatation.

Sources of Upper Gastrointestinal Hemorrhage in Cirrhotic Patients with Esophageal Varices Eddy D Palmer

and Irving B Brick[1] (Georgetown Univ) studied 150 pa tients with histopathologically proved cirrhosis to learn ho often upper gastrointestinal tract lesions other than esophag eal varices caused hemorrhage Esophageal varices wer found in 95, of 59 with a history of serious hemorrhage fro the upper gastrointestinal tract, 47 had esophageal varic and of 91 without history of hemorrhage, 48 had esophage varices. One or more lesions other than the varices wer found in the upper gastrointestinal tract in 39% of the p tients. Of those without history of hemorrhage 20% ha other potential bleeding sites. Other lesions were associat in 22% of the 95 patients with varices Duodenal ulcer, t commonest disease accompanying varices, was found in 10 Gastric ulcer, hiatal hernia and esophagitis were each de onstrated in seven cases.

Of 21 patients who came to autopsy during the study, had varices and 15 had history of hemorrhage Among who died of hemorrhage, sources of bleeding were esopha eal varices in 7, active erosive gastritis in 2, duodenal ulc in 1 and leukemic infiltration of the stomach in 1

The results of the study imply an important warnu against immediate incrimination of esophageal varic when massive hemorrhage is coupled with cirrhosis Th ough diagnostic work up is necessary in each patient Wid application of emergency surgical procedures to halt he orrhage from esophageal varices makes it increasingly i portant to establish the actual source of hemorrhage T knowledge gained from endoscopic and radiologic study the upper gastrointestinal tract in each cirrhotic patie permits rational treatment in the event of complication.

Esophageal Varices Comparative Incidence of Ulcerati and Spontaneous Rupture as Cause of Fatal Hemorrha Hematemesis occurs in 25% of cases of cirrhosis of the liv and is responsible for death in 10-25% The bleeding cirrhosis arises from varicose esophageal veins in 80% ascertain frequency of ulceration Noah H Chiles Archie Bagenstoss Hugh R Butt and Arthur M Olsen[2] (Ma Clinic and Found) studied specimens from 91 cases of ru

---

(1) New England J Med. 246 105 1058 June 18 1953
( ) Gastroenterology 25 564 5 3 December 1953

tured esophageal varices, with death due to hemorrhage. Bleeding points were determined in 80 cases. Gross and microscopic findings were correlated at the exact point of defect to determine whether the lesion represented ulceration into the varix or simple break in its wall.

In 39% no evidence of significant ulceration was found. Minimal infiltrations by polymorphonuclear leukocytes, when found, were assumed to have occurred between time of rupture of the varix and death. In 5% it was uncertain whether rupture occurred spontaneously or whether an ulcer eroded the vessel. In 56%, erosion of mucosa overlying the varix was considered of primary importance in perforation. Ulcers were multiple in 18 cases. Most ulcerated bleeding varices were in the lower third of the esophagus. More men were affected than women.

Esophageal varices usually rank second to peptic ulcer as a cause of massive upper gastrointestinal bleeding and the mortality rate ranges as high as 60-70%.

This study indicates that the primary pathologic change leading to hemorrhage is increased hydrostatic pressure in some cases and mucosal ulceration in others and that these factors may be assumed to co-exist. Ulceration may be overemphasized because of the incidence of ulcerative esophagitis in debilitated subjects and the possibility of an ulcer beginning at the tear of a spontaneously ruptured varix.

If operation is performed before ulceration develops, alleviation of increased hydrostatic pressure may be sufficient. Once ulceration has developed, regurgitation of gastric juice must be prevented or counteracted before the ulcer will heal.

The Emergency and Definitive Treatment of Bleeding Esophageal Varices. Robert R. Linton[3] considers massive hemorrhage from esophageal varices, if treated by medical measures alone, one of the greatest threats to life. Of 128 patients treated without operation at Massachusetts General Hospital in 1934-45, 75% died, 47% due directly to esophageal hemorrhage. Temporary control of the bleeding varix by means of cardiovascular tamponade with an intragastric balloon, then intraesophageal suture of the varix

(3) Gastroenterology 4 1 9 May 1952

comprise the two stage procedure in emergency management of acute hemorrhage which is now used routinely for the control of massive bleeding For more permanent control of bleeding, the authors have for the past two years used direct suture of the varices at the lower end of the esophagus with the balloon tamponade in 11 patients at the time of acute hemorrhage

Direct over and over suture, through the mucosa and beneath the varix, extending it down to include a portion of the gastric mucosa and the large submucosal veins, then carrying it up the esophagus for 5-6 cm is the method for control of bleeding After hemostasis within the esophagus, all old blood is aspirated from the stomach and the incision in the esophagus and cardia is closed transversely Of 14 patients so treated, only 1 died postoperatively Six of the other 13 subsequently had shunt procedures for the definitive control of bleeding as suture alone has no effect on portal venous hypertension, 5 of the 13 experienced secondary bleeding

The construction of a venovenous shunt between the portal vein and the inferior vena cava or the splenic and the left renal veins has successfully prevented bleeding Both operations are based on sound physiologic principles since, by them portal venous hypertension is reduced so that even if esophageal varices persist the pressure within them is lowered enough to prevent their rupture The author allows three to four weeks to elapse between suture and shunt procedures to build up the patient with proper food and vitamin intake to restore blood volume and hemoglobin content and to provide optimal conditions for the shunt operation

Patients who have bled from esophageal varices are more eligible for some type of portacaval shunt than for some other surgical measure The operation cannot, however, be expected to improve liver function nor relieve chronic ascites Suitable only for the patient with a history of esophageal bleeding it applies to three categories of complaint portal cirrhosis without ascites portal cirrhosis with ascites responsive to medication, and bleeding varices with so-called Banti's syndrome The timing of the shunt

operation depends largely on liver condition as reflected in results of liver function tests

The two most successful types of portacaval shunt are (1) direct anastomosis between a portal vein and the inferior vena cava, and (2) anastomosis between the splenic and left renal veins with concomitant splenectomy The first type is not applicable to patients with so-called Banti's syndrome as the cavernomatous changes in the portal vein make it extremely difficult to isolate It is usually reserved for patients with cirrhosis and is easier to use as larger blood vessels are involved, although the proximity of the common bile duct and the hepatic artery creates a hazard

Of two methods of anastomosis of the portal vein and the inferior vena cava one is side to side without interrupting the continuity of the portal vein, the other end to side with implantation of the distal end of the portal vein into the inferior vena cava The second method is preferred as side-to-side shunt may convey hepatic arterial blood from the liver especially if there is a high degree of presinusoidal intrahepatic block, causing serious hepatic anoxia possibly liver failure and death End to-side splenorenal shunt with splenectomy has been more popular at Massachusetts General Hospital than direct portal vein to-vena cava shunt because simultaneous removal of the spleen tends to correct the hypertension so often complicating both cirrhosis and so-called Banti's syndrome It also entails less danger to the vital structures The rule of the thumb has been to perform splenorenal shunt if the spleen is greatly enlarged if the patient has the extrahepatic type of portal bed block or so-called Banti's syndrome whereas direct portal vein to-vena cava is the choice if the spleen is small

Of 79 patients who had shunt operations in 1945-51, 32% had extrahepatic portal bed block secondary to so-called Banti's syndrome and 68% had intrahepatic block secondary to portal cirrhosis In all 83 shunts were constructed—54 splenorenal 20 direct portacaval and 4 of other types Of the 79 patients 15% died postoperatively although of the last 44 patients treated with shunts only 2 (4 5%) have died Only 9% of the 67 survivors have died in the eight months to four years after operation and only 1 of them because of

esophageal hemorrhage Of the rest, 77% greatly improved or were entirely well for one to seven years This type of treatment obviously greatly reduces the number of deaths due to bleeding from esophageal varices when compared to the results of a natural course or conservative medical measures

Caustic Burns of Esophagus and Their Surgical Management Clinicoexperimental Correlation. Thomas H Burford, Watts R Webb and Lauren Ackerman[4] (Washington Univ) correlated the pathologic changes in experimentally produced lye burns of the dog esophagus with those in 17 patients with caustic burns Within a few hours after production of lye burns in dogs there was pronounced to complete destruction of the esophageal epithelium Within 48 hours there was striking evidence of inflammatory change, with thrombosis of submucosal vessels giving rise to local areas of mucosal gangrene After 48 hours bacterial invasion of the muscularis was rather common. After completion of denudation by slough granulation tissue developed rapidly on top of the residual inflammatory zone and organization went on to completion Re-epithelization was a slow process, usually taking six weeks, actual stricture formation was discernible after the second week.

The length of time between ingestion of the caustic and operation on the 17 patients (aged 17 months to 75 years) ranged from 4 weeks to 11 years. Sixteen had ingested lye and one Lysol All were treated surgically In four the eosophageal stricture was short and suitable for a localized resection with end to-end anastomosis In 13, esophagogastric anastomosis was done after resection of the strictured area of the esophagus There were no deaths. Follow up ranged from 6 months to 5¼ years and all patients are swallowing well without regurgitant difficulties

Pathologic study of the resected esophageal areas revealed varying degrees of destruction of the muscular wall of the esophagus, destruction of the esophageal mucosa, replacement of the wall by fibrous tissue, varying degrees of inflammation and, in some cases abscess formation

Results of this study show that dilation of esophageal

(4) Ann Surg 138 453-460 September 1953

strictures after lye burns is not the treatment of choice The pronounced inflammatory and necrotic phase uniformly present during the first seven days after the burn condemns the use of early dilation. Dilation increases fibrous tissue formation, augments infection and delays the reparative process. Most caustic burns should be treated by modern surgery Immediately after the burn, the esophagus should have absolute rest and antibiotics should be administered If stricture is going to develop, definite evidence of its formation will be manifest within two weeks. During this period most patients can be maintained nutritionally by peroral or oral routes or both By the fourth week the patient, following barium studies of the esophagus, is ready for a cautious endoscopic appraisal of the esophagus If there is definite stricture, careful dilation is indicated. If the lesion appears to be one that may be treated by two or three judicious dilations, this should be done However, if it obviously cannot be dilated at the initial examination, resection should be done In long-established cases of esophageal stricture surgery is almost always necessary It should consist of esophageal resection with end to-end anastomosis X ray and esophagoscopy studies should always be made three or four weeks after surgery

[This is the first experimental study of lye strictures of the esophagus, and the authors correlation with human cases is important. The uniform success of their resections is striking and establishes that form of surgical therapy as the one of choice.—Ed.]

Surgical Treatment of Cicatricial Strictures of the Esophagus. Pierre Francioli[5] (Lausanne), after studying numerous operations for the relief of cicatricial esophageal strictures which have failed to respond to progressive dilatation, has found that intrathoracic operations, despite some inconveniences, are more advantageous than extrathoracic technics Although all intrathoracic methods now in use cannot be precisely evaluated on the basis of present experience esophagogastric anastomoses and resection anastomoses will remain the only procedures worth considering until further information becomes available

Substernal esophagoplasty is dangerous both because any failures of suture or any necrosis in the transplant

(5) [illegible] chir acta (supp. VIII) 20 1 72 1953

(which cannot be much shorter than in presternal esophagoplasty) would occur near the wide open mediastinum, and because of fatal accidents resulting from cardiac displacement caused by distention of the transplant Transpleural mediastinal esophagoplasty seems safer, because the length of the intestinal segment can at least sometimes be reduced, thereby lessening the danger of ischemia. Nevertheless, Francioli considers the procedure extremely risky, whether the colon or the jejunum is used, because of possible suture failure Undoubtedly, segmental resection in continuity is the most attractive method to have been proposed it is seldom applicable, however to stenoses produced by caustics because the very short strictures for which it is generally reserved are rare in corrosive esophagitis, moreover it cannot be carried out unless the cardia is intact

Comparison of esophagogastric anastomosis and jejunal esophagoplasty, the least severe and therefore the most acceptable extrathoracic procedure for noncancerous stenosis, clearly leaves esophagoplasty the least desirable Presternal jejunal esophagoplasty, Francioli feels, is justified only when conditions make esophagogastric anastomosis impossible The operative mortality rate in resection anastomosis completely overshadows any possible value the operation may have in preventing cancerization of the cicatricial esophagus in any case a hypothetical development, the operation should therefore be confined to the favorable case in which esophagectomy presents no particular difficulty and the patient's general condition warrants an operation of such magnitude

Careful study of the various tactical possibilities and the methods of approach in esophagogastric anastomoses and resection anastomoses led Francioli to adopt the following principles In any anastomosis involving the supra aortic esophageal segment (rarely needed in caustic burn strictures) preliminary laparotomy and the left thoracic approach should be used In subaortic anastomosis, the left thoracic approach alone is sufficient If the anastomosis is to include the cervical segment of the esophagus, the combined abdominal left thoracic approach must be supplemented by cervical incision and retrovascular transpositio

of the stomach, or, if necessary, the antevascular Sweet type Finally, the combined abdominal right thoracic approach should be reserved for the anastomosis that must be made behind the cross of the aorta—something that cannot be accomplished by the left thoracic route

---

THE STOMACH AND DUODENUM

Psychosomatic Aspects of Vagotomy Linford Rees[6] compared 40 patients examined up to three years after vagotomy with 40 controls who had herniotomy or appendectomy The vagotomy group had a higher incidence of neurosis, mental disorder and peptic ulcer in the family history, of anxious, tense and obsessional traits of personality and of narrow body builds than the controls Improvement of ulcer symptoms and resumption of work occurred in 87 5% of the vagotomy group, but 45% developed additional symptoms and 20% had proved recurrence of ulcer New symptoms occurring after vagotomy included changes in somatic manifestation of emotions difficulties in adjustment, emotional changes or hypoglycemic attacks The best postoperative results were noted in patients with previously stable personalities

The neural pathways leading from the higher autonomic centers via the vagus to the stomach are part of a person's adaptive reactions to his environment When such pathways are severed in vagotomy the patient's mode of adaptation and reaction to environmental and emotional stimuli are altered This explains the considerable individual variation in postvagotomy adjustment and stability The patient with an unstable personality before surgery will have increased difficulties in adjustment and increased neurotic symptoms postoperatively Every effort should be made in pre and postoperative management to counteract neurotic tendencies and to apply rehabilitative measures when necessary to avoid invalidism.

(6) J Ment Sc 99 05 31 July 1953

Late Effects of Antrum Resection on Gastric Secretion Edward R Woodward and Lester R Dragstedt[7] (Univ of Chicago) estimated the quantitative daily secretion of gastric juice for periods of from six months to five years following complete removal of the antrum of the stomach in five dogs prepared with accessory stomach pouches The profound reduction in gastric secretion found after surgery persisted during the follow up period In three animals there was a slight further reduction in gastric secretion, in one no change and in one animal moderate increase at the end of the second year In three animals there was no significant change in quantitative secretory response to a standard dose of histamine, indicating that the parietal cell mechanism remained functional despite long periods of relative secretory quiescence It is probable that complete resection of the antrum of the stomach permanently abolishes the gastric phase of gastric secretion and that there is no compensatory adjustment of other factors causing return of gastric secretion toward normal levels

Perforated Peptic Ulcer, Gastric and Duodenal Primary and Late Results from Treatment with Simple Suture Franz Bierring P A. Gammelgaard and E Hjort Guldhammers[8] (Copenhagen) report that of 240 patients, 90 4% of them men, with perforated peptic ulcer seen in 1940-49, 15% died, of the 231 treated by simple suture 12 6% died. From 1940 to 1944 operative mortality was 24.7% and from 1945 to 1949 5 5% An absolute increase in incidence of peptic ulcer perforation has been noted in Scandinavian countries particularly among relatively young men The incidence of 12 6% perforations of the body of the stomach in 1940-44 fell to 4% in 1945-49 This decrease is attributed to better anesthesia chemotherapy more rational fluid and electrolyte therapy stomach suction postoperatively early mobilization of the patient and better treatment of shock.

Late results were poor in 61% of the 1940-44 group compared to 42% in the 1945-49 group and reoperation was necessary in 37 5% as against 25 7% Follow up disclosed

(7) Am. J Physiol. 173 89 90 April, 1953
(8) Acta chir scandinav 106 128 140 1953

that in patients treated medically for peptic ulcer (gastric and duodenal) the prognosis was worse with perforation. In both periods most of the poor results were among patients aged 41-50. The percentage of secondary deaths was 9.4% in the 1940-44 group and 8.1% in the 1945-49 group.

The standard operation for perforated peptic ulcer should, according to the authors, remain simple suture of the perforation, since primary resection would undoubtedly increase the risk of operation.

Late Results of Treatment of Gastroduodenal Ulcers by Bilateral Vagotomy. R. Guillet and P. Buffard[9] (Lyons) report results, after more than three years, of bilateral vagotomy for gastroduodenal ulcers in 47 patients. None had benefited from prolonged medical treatment, and at least half, because of age or cardiac, renal or pulmonary disease, could not have withstood gastrectomy. The abdominal approach, which makes it possible to confirm the diagnosis and also to carry out a gastroenterostomy if permeability of the pyloroduodenal segment is at all doubtful, was used in 42 patients (90%), however, only 10 required the combined procedure. There was no operative mortality with either the thoracic or the abdominal approach, and pain was immediately and completely suppressed in 43 of the patients. Two of the others had partial postoperative relief and two had no improvement. Although 16 patients were lost to follow up, of those re-examined three or more years after operation, 17 (60%) had perfect results, having normal working capacity and weight and requiring no special diets or medication. Results in the other 9 (30%) were good despite some mild symptoms, such as intolerance for milk and the need for bismuth after an unusually heavy meal and incomplete recovery of weight and reduced working capacity. All were satisfied and would again have accepted the operation under similar circumstances.

Neither vagotomy nor gastrectomy is the perfect treatment for gastroduodenal ulcer but because vagotomy has a lower mortality rate and late results comparable to those after gastrectomy its efficacy should not be disputed, attention should be focused on its proper use. Vagotomy is

(9) L on chir 48 450 466 May-June 1953

definitely contraindicated for hemorrhagic ulcers or those suggestive of malignancy The chief indication for vagotomy arises when gastrectomy would be dangerous because of local conditions or the patient's general state Vagotomy is also preferable to gastrectomy in the young person who is in good general condition, because it may prove curative, yet does not preclude later gastrectomy if necessary

Carcinoma of Cardiac End of Stomach. In contrast to the disappointing results of surgery in most esophageal cancer, the prognosis in carcinoma of the distal end of the esophagus and cardiac portion of the stomach is much more favorable Sweet reported 17 5% of patients alive five years after surgery, with this figure rising to 40% for those who had no lymphatic metastases.

J F Nuboer[1] (State Univ of Utrecht) reports on 149 patients with malignant tumors at the junction of esophagus and stomach Resection was possible in only 90 Resection was curative in 55 and in 35 was only palliative because of metastasis to the liver Since stenotic symptoms predominate, palliative resection is justifiable despite increased risk. Of the 90 tumors, 59 were adenocarcinoma and 9 were epidermoid carcinoma, whereas Sweet reported 93 cases of adenocarcinoma and 99 of epidermoid carcinoma

Extension in the wall occurs chiefly in the submucosal layer and may extend either proximally or distally The growth along the lesser curvature is more extensive as lymph flow in an oral direction is blocked early, reversing the flow in the direction of the pylorus. When perforation of the gastric wall and peritoneal metastasis occur the tumor is incurable Resection should extend, orally and distally at least 2 or 3 fingerbreadths beyond the palpable and visible rim of the tumor and should include contiguous involved structures and the spleen If at all possible a portion of stomach should be retained

TECHNIC —The cardia and fundus are removed with the lymph nodes of the region and the entire lesser curvature A strip of remaining stomach along the greater curvature is sutured to form a tube and is anastomosed end to-end with the remaining esophagus at any level desired even above the aortic arch. This reduces the acid producing portion of the stomach peptic esophagitis or ulcer

(1) Proc Roy Soc Med. 47 109-116 February 1954

ation were not observed postoperatively Suction drainage of the left thoracic cavity at 30 cm. of water is maintained for 48 hours. On the 3d or 4th day drip feedings of glucose and amino acids are begun through the nasal tube, which at operation is always placed through the anastomosis as far as the duodenum Feeding per os is begun on the 5th day If resection is impossible, anastomosis to a Roux Y loop may be made to the esophagus above the tumor

Exploration was carried out in 147 of 149 patients. Total gastrectomy was performed in 12, with mortality of 8 3% When partial resection was performed with curative intentions, mortality rate was 10 9%, when of a palliative character, 26 1% Resection was performed in 77 men and 13 women, 33 were over 65

Of 20 followed five years or more, 7 are alive, a survival rate of 35% Some deaths were due to intercurrent disease, indicating that carcinoma around the cardia is one of the least malignant gastrointestinal carcinomas

Elucidation of Intestinal Sensitivity Factor and Distance Factors in Incidence of Stomal Ulcers in Billroth II Type Gastrectomy Factors in the genesis of stomal ulcer include (1) secretin factor (2) alteration of neutralizing capacity *of alkaline juices the farther they progress from portal* of entry into the lumen, and (3) sensitivity factor, implying increased susceptibility of mucosa of successively lower segments of the small intestine A short afferent loop in the Billroth II gastrectomy is important Following a 75% Billroth II gastrectomy, utilization of an afferent loop 27 cm. or longer frequently resulted in stomal ulcers in dogs subjected to histamine stimulation.

Lawrence B Kiriluk and K. Alvin Merendino[2] (Univ of Washington) subjected 45 dogs to 75% Billroth II gastrectomy A Hofmeister closure was made on the lesser curvature and the duodenum inverted The dogs were divided into groups of 15 each differing in length of afferent loop and source of intestinal mucosa utilized in gastroenterostomy After resection a rest period of at least 45 days was allowed then each dog received 45 daily intramuscular injections of 30 mg histamine phosphate in beeswax In group I, the afferent loop was kept constant at 15 cm and consisted entirely of duodenum A 10 cm segment of jejunum in each series

( ) Surgery 35 530-546 April, 1954

(atropine methyl nitrate), properly administered, is an addition to medical therapy

Fredet Ramstedt pyloromyotomy is a satisfactory operation for pyloric stenosis Efficient division of the hypertrophied circular muscle, allowing the submucosa to bulge into the wound, is followed by relaxation of the muscle As the muscle coat relaxes the cut edges are slowly drawn together by fibrous connective tissue of the serosa The wound heals in 9 13 days

The mortality rate before Ramstedt's operation was 80% Surgical mortality dropped to near zero with greater awareness of the condition and earlier treatment.

The operation is not an emergency and should be delayed until the effects of starvation, dehydration, loss of chlorides and other biochemical changes produced by persistent vomiting are completely remedied The operation is short and is performed under light inhalation anesthesia with local infiltration Postoperatively, delayed gastric emptying time is anticipated and slowly increasing amounts of glucose saline are given, followed by breast milk or some other easily digestible formula In infants who have had pyloric difficulty for some days there may be a tendency to vomit from failure of co-ordination

Effect of Subtotal Gastrectomy on External Pancreatic Secretion in Dogs Bayliss and Starling have shown that on introduction of dilute hydrochloric acid into the duodenum a hormone, secretin, is released from the duodenal mucosa into the blood stream Larger quantities are found in the more proximal portions of the small intestine than in the more distal segments On injection secretin stimulates pancreatic secretion of water and bicarbonate Enzyme secretion depends either on stimulation of the vagi or on another hormone, pancreozymin, elaborated in the intestinal mucosa In an attempt to lessen the voluminous pancreatic secretion which may be produced in acute pancreatitis, gastric aspiration and anticholinergic drugs have been used to reduce gastric acid Similarly chronic pancreatitis has been treated by subtotal gastrectomy

Alexander Richman Louis J Lester Franklin Hollander

and David A Dreiling[4] (Mount Sinai Hosp, New York City) created duodenal fistulas in four dogs, to permit cannulation of the major pancreatic duct, and studied the response of the pancreas to a meal of lean beef, histamine diphosphate given subcutaneously and secretin given intravenously, before and after subtotal gastrectomy It is assumed that histamine induces pancreatic secretory activity by virtue of the increased production of hydrochloric acid and resultant secretin formation Hence, histamine injection, like ingestion of meat, affords a measure of the gastric influence on pancreatic secretion, secretin injection, a direct measure of pancreatic reactivity

After subtotal gastrectomy, there was no essential change in the ability of the pancreas to respond to a standard dose of exogenous secretin. The response to meat after operation was diminished as follows volume rate of secretion, 65%, bicarbonate concentration, 38%, and amylase output, 68% With histamine, volume decreased 61%, bicarbonate concentration 18% and amylase output 67%

An interference with the interrelation of the gastric and pancreatic secretory processes becomes obvious when one considers the sharp reduction that occurred in the components of pancreatic juice with food and histamine used as stimuli after gastrectomy These changes arise from diversion of food and hydrochloric acid into the lower small intestine where secretin is present in lesser degree Wangensteen has noted a higher incidence of gastrojejunal ulcer after gastrectomy with a long afferent loop than with a short loop This is ascribed to a by passing of the secretin producing area with lessened output of pancreatic juice and diminished acid neutralization. Steatorrhea after gastrectomy may possibly be similarly explained

Diminution in pancreatic secretion after gastrectomy may benefit patients with chronic pancreatitis by lessening the distention of the constricted, obstructed, pancreatic duct

Total Gastrectomy by Transthoracic Approach Subsequent Report Richard H Sweet[5] (Boston) evaluates the re

(4) Gastroenterology 26 310 20 February 1954
(5) Ann. Surg 138 9 310 September 1953

sults of total transthoracic gastrectomy in 84 cases, including 79 of malignant tumor (2 lymphosarcomas and 77 carcinomas) Early in the series a strictly thoracic approach was used in most cases, but recently the abdominothoracic modification of the incision has been employed more often When the operation is performed for removal of extensive carcinoma of the stomach, all the important lymph node bearing areas must be widely extirpated. The large omentum has always been removed The stomach alone was removed in 27 of the 77 carcinoma cases. In 27, the spleen was also removed, in 14, the spleen and pancreas were removed, in 4, spleen and colon, in 2, spleen, pancreas and colon, in 1, spleen and portions of the liver in 1, spleen, pancreas and portions of the liver, and in 1, spleen, pancreas and portion of the liver and colon. Several methods can be used to restore the continuity of the alimentary canal after total gastrectomy, depending on the exigencies of the case or choice of the surgeon. Esophagoduodenostomy was performed in 17% of cases and esophagojejunostomy in 83% Esophagojejunostomy was of either of the Roux Y or the end to-side method, with or without elongation of the mesentery

The seven patients who did not have carcinoma obtained a good result, and none has died Of the 77 with carcinoma, 15 died Causes of death were sepsis, six cases, cardiovascular disease, six duodenal fistula, one, and uremia, two Deaths from sepsis have decreased since the advent of antibiotics. In the carcinoma group, 56% had invasion of the cardia and lower esophagus and 75% had lymph node metastases Of those who survived operation 76% were alive at 6 months, 42% at 12 months, 31% at 18 months, 24% at 2 years, 20% at 3 years, 16% at 4 years and 7% (2 patients) at 5 years

The thoracic or abdominothoracic approach is indicated in all cases in which total gastrectomy is to be performed especially if the disease to be removed is carcinoma, because of the superiority of exposure of the operative field ease and safety with which anastomosis can be done and increased scope of extirpation allowed including removal of a long segment of the esophagus if required To provide the means

to remove, with the primary tumor, the greatest possible amount of tissue which might be involved by direct invasion or metastases to lymph nodes, it is suggested that all operations should include removal of a long segment of the esophagus paracardial and left gastric lymph nodes, spleen, left half of pancreas, sufficient cuff of duodenum, lymph nodes in the duodenal area, and the great omentum If carcinoma does not recur, patients who have had a total gastrectomy can maintain a satisfactory level of health and enjoy active and useful lives

Stenosis of Stomach Caused by Corrosive Gastritis from ingestion of caustic material is reported by Alberto L C Maggi and M Mecroff[6] (Buenos Aires)

Woman 30 attempted suicide by drinking commercial hydrochloric acid With prompt treatment, the oral lesions healed rapidly, but in a month typical early postprandial vomiting began. Six months later there was epigastric fulness but no dysphagia. Six months thereafter, malnutrition was apparent X rays showed the esophagus free from involvement but in the stomach a stricture at the junction of the middle and inferior thirds of the body and extending to involve the pyloric antrum. The stomach was dilated above the stenosis There was a histamine resistant achlorhydria. Gastroscopic diagnosis was superficial gastritis. An extensive gastrectomy of Reichel Polya type was done Recovery was uneventful Pathologic diagnosis was cicatrized fibrosis of the submucosa

The essential feature which predetermines the sparing of the esophagus despite a gastric lesion is the chemical nature of the caustic material. The esophagus may be spared if the material is acid but never if it is alkaline The only therapy is surgical with subtotal gastrectomy the treatment of choice

Gastrectomy with Replacement F Austin Henley[7] lists the following hazards of the Billroth II operation virtual exclusion of the duodenum from the gastrointestinal tract in the retrocolic procedure production of an internal hernia by passing the jejunal loop through the transverse mesocolon with possible obstruction to the afferent loop and in the antecolic anastomosis the possibility of the long afferent loop causing obstruction either of itself or of the transverse colon

(6) Gastroenterology 24 8 2 3 6 August 1953
( ) Ann. Roy Coll. Surgeons England 13 141 160 September 1953

Passage of the gastric contents through the duodenum causes a neural and hormonal response from Brunner's glands In the dog and probably also in man, the mechanism requires continuity of the gastrointestinal tract for initiation of the peristaltic wave in the duodenum without which the duodenum may be sluggish and inactive Complete emptying of the gallbladder and the volume of bile secreted are both regulated by the presence of particular foods in the duodenum. Pancreatic secretion is correlated with the rate of inflow of bile into the duodenum. The flow of succus entericus is most profuse at the proximal end of the small intestine

After the Billroth II operation, there is rapid passage of food through the stomach and into the small intestine, with little time for stimulation and production of gastrointestinal juices This causes the confused physiologic response known as the "dumping" syndrome With failure of the normal physiology of digestion, such symptoms as diarrhea and steatorrhea with resultant weight loss become apparent. Poor iron absorption and iron deficiency anemia may also result The Billroth I operation gives, on the whole a better functional result than the Billroth II, but the percentage of satisfactory results is still too low The Billroth I operation is not always feasible because of technical difficulty Jejunal replacement allows the advantages without the disadvantages of the Billroth I and can be performed when the Billroth I is not technically feasible It also eliminates the anatomic and physiologic dysfunctions of the Billroth II

TECHNIC.—Through a midline incision after mobilization of stomach and duodenum, the duodenum is resected between Payr's clamps. A special crushing clamp is applied at the proposed site of section of the stomach, and the stomach is laid aside. A segment of the duodenojejunal flexure—8 in. long for replacement in total and 5 in in partial gastrectomy—is selected as near the duodenojejunal junction as possible Blood supply to the segment must be adequate with as little interruption of the vascular arcade as is compatible with the mobility of the segment The segment is isolated between de Martel clamps and, after restoration of continuity of the jejunum, is brought through a window made to one side of the middle colic artery in the transverse mesocolon (Fig 78) The distal end of the graft is anastomosed to the duodenum The de Martel clamp is then removed and the mesenteric half of the free end oversewn.

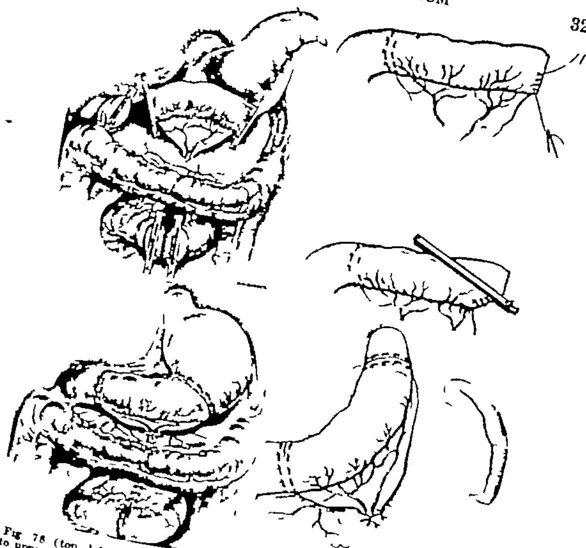


Fig 78 (top left) —Isolated jejunal segment taken through transverse mesocolon into upper abdomen

Fig 79 (top right) —Oversewing of mesenteric half of proximal end of jejunal graft note placement of clamp.

Fig 80 (bottom left) —Completed operation showing disposition of jejunal graft between stomach and duodenum

Fig 81 (bottom, right) —Jejunal replacement for total gastrectomy (Courtesy of Henley F A. Ann Roy Coll. Surgeons England 12 141 160 September 1953)

A Payr crushing clamp is then placed obliquely across (Fig 79) and the redundant part of jejunum removed, thereby enlarging the stoma. After anastomosis between the stomach and the proximal end of the graft a final stitch closes the hiatus in the transverse mesocolon and attaches it to the jejunal mesentery (Fig 80) In total gastrectomy the graft is anastomosed end to-end to the

gus and duodenum (Fig 81) In severe postgastrectomy disorders, the Billroth II operation can be converted into a jejunal replacement

After jejunal replacement, done in 73 patients, the only symptom noted by the patients was sudden fulness during eating There was no nausea, vomiting, bowel dysfunction or "dumping" syndrome Because of three (4 1%) recurrences of ulcer, the pH of the gastric mucosa is now measured by direct contact during the operation. As the recording apparatus leaves the body of the stomach, traveling toward the cardiac end, the pH approaches 7, and a level is thereby selected for resection where theoretically the chance of recurrent ulceration should be minimal or absent No delay of emptying or duodenal ileus has been noted

Extravagal Influences on Gastric Hydrochloric Acid Secretion Induced by Stress Stimuli. J D French, R L Longmire, R W Porter and H J Movius[8] (Univ of California, Los Angeles) experimented with 31 Macaca mulatta monkeys.

TECHNIC.—Chloralosane was used intraperitoneally for anesthesia to avoid stressing the animal or blocking its subsequent responses to stressing agents. Bilateral vagotomy, adrenalectomy or both, when done, were performed transabdominally Normal saline and cortisone were given daily after adrenalectomy

Earlier experiments demonstrated that alteration of pH of gastric contents followed two distinct patterns on direct stimulation of the hypothalamus. The early response was eliminated by section of the vagi and the late response was eliminated by adrenalectomy

ACTH injected into adrenalectomized monkeys produced no gastric response indicating that the adrenal cortex was essential to the mediation of its influence The response to cortisone was not altered by vagotomy In the normal animal, insulin induced hypoglycemia produced pH graphs suggesting superimposition of both early and late responses. When this was repeated in vagotomized animals there was only a pituitary adrenal response, whereas adrenalectomized animals displayed a pure vagal response No response was obtained in animals after they had had both vagotomy and adrenalectomy No response to insulin occurred with any

(8) Surgery 34 621-632 September 1953

of the preparations tested when hypoglycemia was prevented by the addition of glucose Hypoglycemia activated both early and late responses Cephalic outflow over the sympathetic nervous system does not appear to participate Epinephrine elaborated by direct or reflex stimulation of the adrenal medulla initiates the pituitary-adrenal response to hypoglycemia Blocking with SKF* 501, a potent adrenergic blocking agent, eliminated the late response and, when used in animals after vagotomy, both effects were eliminated Injection of epinephrine produced a pituitary adrenal like response which was eliminated by adrenalectomy

There is evidence that pituitary adrenal mechanisms similar to these described in animals also exist in man An adverse effect on peptic ulcer formation of ACTH and ACH therapy has been noted in certain patients and analyses of gastric responses in patients to the administration of insulin and epinephrine follow closely the responses in the animals described Whether or not such extravagal cephalic influences are important in clinical gastrointestinal pathology requires further observation. It is easy to see how physical and emotional stress could affect gastric physiology in several ways

The Aftermath of Perforated Duodenal Ulcer was studied by Samuel J Stabins[9] (Univ of Rochester) in 249 patients, 92 7% of them men In 8% there had been no history of ulcer symptoms and in 71% symptoms of less than a year X rays were taken of 51 4% of patients and showed free air in 72 6% of these Surgery was done in 95.2% with 12 7% mortality

Recovery was satisfactory in 167 Follow up disclosed major sequelae in 109 (65 1%) Re perforations occurred in 15 recurrence of active ulcer symptoms in 14, pyloric obstruction in 57 and subsequent hemorrhage in 23 In 27 5% of those with major sequelae the symptoms recurred within six months of closure Definitive surgery became necessary in 36 5% of the patients followed. Operative mortality was higher among patients who had procedures additional to simple closure, gastric resection was not performed in this group

(9) Surgery 34 614-620 September 1953

The relatively high proportion who had ulcer symptoms less than six months after surgery raises the question of whether or not gastric resection should be performed at the time of perforation. Because of the technical danger of turning in an acutely inflamed duodenum, it would seem more reasonable to advise gastric resection after the pathologic process has resolved itself

Diverticula of Duodenum Indications for and Technic of Surgical Treatment M. M Zinninger[1] (Univ of Cincinnati) believes that, though duodenal diverticula are relatively frequent and seldom produce symptoms of any clinical significance, at times they may account for persistent and distressing symptoms and may be the sole cause of pain or vomiting Pseudodiverticula occur with duodenal ulcer, and any symptoms arise from the ulcer or pyloric obstruction. Primary or idiopathic diverticula arise almost exclusively on the concave side of the duodenum and seem to be related to defects in musculature along the course of blood vessels entering or leaving the bowel. The walls are deficient in part or all of the muscle layers They are most common in the descending part of the duodenum, usually near the ampulla of Vater They are usually small and insignificant They often occur in the transverse portion, especially just proximal to the duodenojejunal junction These are frequently large and often cause symptoms.

For diverticula of the first and second portions of the duodenum, surgical approach should be from the lateral or right side of the duodenum After division of the posterior peritoneal reflection, the duodenum should be rolled to the left, the diverticulum then can be freed from the pancreas. The duodenum may be distended with air through a 20 gauge needle to aid in dissection. In certain cases, dissection can be facilitated by opening the duodenum and inserting a finger into the diverticulum In the region of the common duct the diverticulum should be opened and the interior of the duodenum inspected to avoid encroachment on the common duct The transverse portion may be approached from above the transverse colon if proximal to the mesenteric

(1) A M A Arch. Surg 66 846-856 June 1953

vessels and from below if distal to the vessels No routine maneuver is universally successful

Man 60, for three years had indefinite epigastric pain which slowly progressed to severe, cramplike, lower retrosternal pain He lost 12 lb in six months X rays showed a large, somewhat bilobed diverticulum arising from the third or fourth part of the duodenum, which retained barium for more than 24 hours At operation, an attempt to find the diverticulum from the right of the mesenteric vessels was unsuccessful and the inferior leaf of the transverse mesocolon was divided just proximal to the ligament of Treitz. After exposure of the upper margin of the fourth portion of the duodenum, the latter was rolled downward. The sac of the diverticulum was dissected, the neck clamped and cut, and the stump inverted The patient had excellent therapeutic results with relief of all discomforts

Vagotomy and Gastroenterostomy—Vagotomy and Conservative Gastrectomy Comparative Study L W Edwards and J Lynwood Herrington, Jr[2] (Vanderbilt Univ) present results of performing vagotomy as an integral part of duodenal ulcer operations in 121 patients during 1946-51. Of 17 patients who had vagotomy alone, 1 died of unrelated cause, in the other 16 results were excellent in 44%, satisfactory in 25% and poor in 31% Of 39 who had vagotomy with gastroenterostomy, 1 died, and follow up of the others disclosed 60.5% excellent, 29% satisfactory and 10.5% poor results Of 31 who had vagotomy and pylorectomy, 1 died of unrelated cause, and follow up of the other 30 disclosed 80% excellent, 10% satisfactory and 10% poor results. Of 34 who had vagotomy with antrectomy 4 died, and follow up of the other 30 disclosed 83% excellent, 7% satisfactory and 10% poor results

Gastric retention is the chief problem after vagotomy alone for duodenal ulcer Among objectionable features of vagotomy with gastroenterostomy is the creation of a dual route of emptying from the stomach—a possible source of undesirable side effects An increase in pyloric tone may play an important role in symptoms The presence of a well functioning gastroenteric stoma precludes adequate filling of the duodenal bulb on radiologic examination, thereby complicating the evaluation of ulcer healing The operation fails

(²) Ann. Surg 137 8 3 843 June 1953

to remove the pathologic lesion. Vagotomy with pylorectomy gives excellent results but does not remove the antral phase of hydrochloric acid secretion Vagotomy with antral resection is probably the best operation for duodenal ulcer in that it removes both the cephalic and the antral phases of hydrochloric acid secretion This reduction of peptic activity to a minimum should reduce recurrent ulceration. The operation has the added advantage of preserving the storage function of the stomach Patients examined five years after vagotomy with antrectomy have shown no detrimental effects resulting from ablation of both phases of gastric secretion

Efforts should be made to sever completely all branches of the vagus nerve Antral resection is carried out proximal to the region of the incisura angularis The operation entails removal of slightly more than the antral segment and provides a 35-40% resection A Billroth II type of reconstruction is then carried out

Improvement of 180% in Five Year Survival Rate of Patients with Carcinoma of Stomach According to Waltman Walters and Joseph Berkson[3] (Mayo Clinic), five year survival rate among all patients with carcinoma of the stomach examined at Mayo Clinic in 1940-49 is 14%, compared to 5% in 1907 16 During that time the number of patients who underwent laparotomy has increased, as have the number of resectable lesions the number of patients who survived resection and the percentage of total gastrectomies. The 5 year survival rate after gastric resection has increased from 29 2% in the 1907 16 series to 34 8% in the 1940-49 group and 10 year survival rate from 21 7 to 26 7% The increase in the number and magnitude of surgical procedures and the striking reduction of the operative risk have been due to improvements in diagnosis, pre and postoperative treatment and operative technic Improvements in raising the patient s nutritional status, replacing electrolyte loss, anesthesiology use of oxygen, blood, antibiotics and in surgical technic have all contributed to the increased survival rate

The rate of resectability was 25 5% when calculated in

(3) Ann. Surg 137 884 890 June 1953

all patients with cancer of the stomach examined in 1907-38 This rose to 44% in 1940-49 Mortality for subtotal gastric resections for cancer dropped to 7 9% in 1951, and in 62 cases of total gastrectomy for 1948-50 to 12 9% Even with these operations of greater magnitude, 40% of all cancer patients examined survived gastric resection or total gastrectomy in 1940-49 as against only 22% in 1907 16

Further improvements in longevity statistics doubtless will depend on earlier recognition of the presence of the malignant gastric lesion and getting the patient into the hands of the surgeon when the lesion is still resectable

Vagotomy in Treatment of Peptic Ulcer Paul Banzet[4] (Paris) states that, although vagotomy has a very efficient action on peptic ulcer of the stomach or duodenum, he does not use it routinely Gastrectomy is preferred when the patient fails to respond to medical therapy The mortality rate is about 1% and about 85% of patients have excellent results Vagotomy should be reserved for certain selected cases (1) In recurrence after gastrectomy or gastroenterostomy, another resection is done if it was not done correctly before and is followed by a vagotomy (2) Stomal ulcer after gastroenterostomy is treated by gastrectomy, jejunectomy and vagotomy, in that order (3) In difficult duodenal ulcer which is situated far to the right so that removal would endanger the common duct, vagotomy is combined with gastroenterostomy

Vagotomy is not done for gastric ulcers because of the danger of carcinoma when the ulcer is located on the lesser curvature

Clinical Analysis of Billroth I and Billroth II Subtotal Gastric Resections Horace G Moore, Jr., Ralph J Schlosser John K. Stevenson, Henry N Harkins and Hilding H Olson[5] (Univ of Washington) report 104 Billroth I and 135 Billroth II subtotal gastrectomies performed during 1948-52 The two series were comparable from the standpoint of age sex, duration of disease and indications for surgery

The extent of resection was determined by measuring the

(4) Postgrad. Med. 13 491-494 June 1953
(5) A.M.A. Arch. Surg. 67 4 2* July 1953

areas of patterns of the residual stomach and the actual stomach removed with the polar planimeter In 24 of the Billroth I resections the distance from the entrance of the common bile duct at the major papilla to the severed end of the duodenum was measured The average distance was 5 8 cm., ranging between 2 and 8 cm. No similar data were available for the Billroth II series.

Pulmonary complications and wound infections were the postoperative complications most commonly encountered. Hospital mortality in the Billroth I group was 3 8% and in the Billroth II series, 7 4%

Follow up data indicated poor results in 6 5% of 92 Billroth I patients and 25% of 76 Billroth II patients The mortality rate, when limited to peptic ulcer patients, was 2.2% in 91 Billroth I cases and 8.2% in 122 Billroth II cases Of the Billroth I group none had recurrent ulcers. In the Billroth II series three patients had recurrent ulcers and two others had symptoms of marginal ulcer, not proved In the Billroth I group 74 8% either maintained or surpassed their operative weight compared with 53 4% in the Billroth II group None of the Billroth I and only two of the Billroth II group had severe dumping By strict criteria, 40 5% of the Billroth I and 44.3% of the Billroth II group had some symptoms of dumping

The criticisms usually made of the Billroth I operation are critical angle leakage stomal obstruction, inadequacy of resection and inapplicability to duodenal ulcer However, an average of 72% of the stomach was resected in the 32 cases in the Billroth I group which indicates the criticism is not justified The Finney end to-side modification of the Billroth I procedure is now used when it is necessary to leave the ulcer or ulcer scar in the duodenum. Advantages of the Billroth I operation are it is faster and easier, it prevents duodenal stump blowout, the entire operation is performed in the supramesocolic compartment of the abdomen the duodenum is probably more resistant to peptic ulceration than is the jejunum more nearly normal gastrointestinal function occurs, and acid in the duodenum supposedly inhibits gastric secretion.

Surgical Procedures for Peptic Ulcer Critique of Committee Report. Keith S Grimson[6] (Duke Univ) favors vagotomy with gastroenterostomy after seven years of trial, and thereby differs with the Committee on Surgical Procedures whose report in November 1952 favored subtotal gastrectomy

Vagotomy with gastroenterostomy is associated with less risk because of its lesser magnitude and because diseased tissues can be avoided Its use when resection would be difficult reduces the mortality rate The difference between rates of 0 5% for vagotomy and 1% reported for resection means that resection in preference in vagotomy and gastroenterostomy has resulted in death of 1 patient in 50, which is justifiable only if surviving patients are much improved after resection

No great difference between the treatments was recorded for relief of ulcer pain Satisfaction with vagotomy and gastroenterostomy equals that with minimal gastric resection, but not with maximal resection

For postoperative hemorrhage, average percentages for minimal and maximal resection together indicate that 4.3% of patients who had not bled before operation had hemorrhages, whereas only 2 1% hemorrhaged after vagotomy and gastroenterostomy Similarly the average of percentages for resection in patients who had bled was higher (8 6%) than for vagotomy and gastroenterostomy (6 5%)

Data concerning weight were not available from the questionnaire on resection. However, the comment "incidence of weight gain at the end of two years of follow up was higher after vagotomy plus gastroenterostomy than following vagotomy plus resection," has some bearing It would seem that physicians contemplating resection in malnourished patients assume an added responsibility of possible further weight loss

The lower incidence of dumping syndrome after vagotomy and gastroenterostomy balances the slightly greater incidence of diarrhea after this procedure The percentages of patients able to work after resection are slightly lower than

---

(6) Gastroenterology 24:?75 30 June 1953

those after vagotomy and gastroenterostomy With regard to satisfaction with the procedure, there is no evidence that subtotal gastrectomy is superior

Use of vagotomy for certain ulcer problems, particularly jejunal ulcer, and of resection for others, gastric ulcer or exsanguinating hemorrhage, seems justified and is becoming common Difference of opinion exists as to which procedure should be used for duodenal ulcer In view of the lesser mortality risk and comparatively favorable results, vagotomy and gastrojejunostomy could be used advisedly

Bleeding Peptic Ulcer Harry C Saltzstein, Murray S Mahlin and Schavel R Scheinberg[7] (Harper Hosp., Detroit) report 402 cases of upper gastrointestinal bleeding during 1947-51 which included 278 (69%) duodenal ulcers, 53 (13%) gastric ulcers, 12 (3%) marginal ulcers and 59 (15%) undiagnosed During the five years there were 1,367 hospitalizations for peptic ulcer Thus hemorrhage from peptic ulcer accounted for 25% of the total admissions for ulcer

Of 343 patients with bleeding peptic ulcer, 80% were treated medically and 20% surgically Medical mortality was 5 1% and surgical 5 9% Of the medical deaths, 64% were caused by myocardial infarct or cerebrovascular accident Bleeding in the age group below 45 is less, but is by no means negligible In this series, 2 of the 18 who died were under 45 Of these 18 14 (78%) had hematemesis and 4 (22%) had melena alone Pyloric obstruction did not increase the seriousness of the bleeding Perforation was associated in five patients Three died in shock from uncontrolled hemorrhage in the medically treated group Death due to gastric ulcer is almost three times as frequent as it is in duodenal ulcer patients

The aim in treatment of upper gastrointestinal hemorrhage is largely to avert the ill effects of anoxia Sufficient blood must be given to prevent anoxia of the liver primarily the myocardium and brain. The decision to operate does not have to be made in 48 or 72 hours if the patient can be maintained without anoxia There is great advantage

(7) Arch. Surg 6 29-42 July 1952

if anemia, blood loss and electrolyte imbalance are corrected preoperatively

Hemorrhage is most treacherous when bleeding lasts for a few days, stops, then starts again, especially if shock ensues each time These patients are bleeding from an open posterior vessel and are liable to have sudden hemorrhage Such patients should be operated on It is not necessary to have a long or even recent history of peptic ulcer to have massive hemorrhage from it, especially in patients past 60 Between 10 and 15% have no ascertainable previous history of ulcer

A certain small percentage comes to operation with the bleeding undiagnosed and ulcer will not be found. There is difference of opinion as to whether resection is indicated in these cases Uncontrollable postoperative hemorrhage frequently comes from the duodenal stump but may come from the anastomotic suture line, and manual evacuation of clots from the residual gastric stump may permit the stomach to contract sufficiently to arrest the bleeding

Gastroenterostomy with Resection of Vagus Nerves in Treatment of Adherent Duodenal Ulcers N Blixenkrone Møller[8] (Univ of Aarhus) performed gastroenterostomy with resection of the vagus nerves in 28 patients who had densely adherent duodenal ulcers with inflammatory infiltration. Immediate results were good Follow up 14 months to 4 years after operation disclosed that 75% of patients had no gastrointestinal symptoms and 14% had only mild symptoms. In 11% (3 patients) the result was poor, one patient had to be reoperated on for dumping syndrome and one for gastrojejunal ulcer, in one the duodenal ulcer failed to heal. The operation considerably reduced the output of gastric acid, a result considered to be important for a favorable end result

In all 28 patients lengths of the two main vagus trunks and in 13 patients one or more accessory nerve fibers were also resected An insulin test performed 10-14 days after operation showed a striking increase in acid secretion in three patients, as did follow up in seven patients This was

(8) Acta chir scandinav 105 33-44 1953

attributed to failure to achieve complete vagotomy because of anatomic variations in vagus distribution, some fibers may traverse the diaphragm at a distance from the esophageal hiatus and others may be buried in the esophageal wall. The possibility that sympathetic nerves to the stomach contain cholinergic fibers must also be considered The function of these fibers may be increased after the resection of the main vagus trunks No correlation could be demonstrated between the result of the insulin test and the clinical result. The reduction in acid production obtained by vagotomy is nevertheless considered important

The principal procedure in surgical treatment of duodenal ulcer should be extensive gastric resection, preferably by Polya's method But if the ulcer is densely adherent or surrounded by considerable inflammatory infiltration, so that gastric resection would involve too much risk of injury to the common bile duct or defective closure of the duodenal stump, gastroenterostomy with resection of the vagus nerves is indicated It must be emphasized that in the vagotomy, which should be performed in close conformity with the directions given by Dragstedt, every precaution must be taken to interrupt all accessible fibers of the vagus nerves

Antrum Motility as Stimulus for Gastric Secretion Lester R Dragstedt, Harry A. Oberhelman, Jr, Jose M Zubiran and Edward R Woodward[9] (Univ of Chicago) describe the effects of various procedures on the total output of gastric juice from a Pavlov pouch in a dog After the pouch was constructed so that the nervous, gastric and intestinal phases of gastric secretion could operate the hydrochloric output was normal and averaged 147 mEq /day When the antrum of the stomach was exteriorized by transplantation into the abdominal wall without interference with the blood supply along the greater and lesser curvatures, so that the nervous and intestinal phases of gastric secretion alone remained the output of HCl decreased to 48 mEq /day This would suggest that the antrum is by far the most important factor in provoking the secretion of gastric juice from the usual type of Pavlov pouch When the bridge connecting

(9) Gastroenterology 4 71 8 May 1953

the Pavlov pouch with the main stomach was divided, there by severing the vagus innervation and converting it into a Heidenhain pouch so that only the intestinal phase of gastric secretion remained, the average output of HCl was 15 mEq /day

When the exteriorized antrum was transplanted into the colon the average acid output from the denervated pouch was almost as great as when the antrum was present in its normal location and the vagus nerves to the pouch were intact This would suggest that stimulation of the antrum is not necessarily due to food or the primary products of digestion, since these had been largely removed from the contents of the colon The resection of two thirds of the transplanted antrum produced a striking decrease in acid output to an average of 29 mEq /day The original blood supply to the antrum transplant was then divided so that the antrum was nourished only by newly formed blood vessels from the colon The portion of the colon that contained the transplant was converted into an isolated fistula open at both ends, so that all traces of food and feces could be removed by washing Under these conditions the secretion of gastric juice from the isolated denervated gastric pouch decreased to an average 10 mEq /day However, when the distal end of the isolated segment of colon was occluded so that some tension could be developed as a result of peristalsis the secretion of gastric juice was strikingly increased to an average free acid output of 72 mEq /day The intraluminal tension developed by peristalsis in the isolated segment of colon in response to the obstruction was probably an effective stimulant to antrum function.

It is concluded that the hormonal or antral phase of gastric secretion is most important the nervous phase somewhat less and the intestinal phase least important in provoking the secretion of gastric juice from a Pavlov accessory stomach pouch. The significance of this finding as a possible explanation for the increase in gastric secretion accompanying pyloric stenosis in man is suggested

Relation of Gastric Ulcer to Carcinoma of Stomach is discussed by Samuel F Marshall[1] (Lahey Clinic) Of 411 con

(1) Ann. Surg 137 891 903 June 1953

secutive cases of gastric ulcer in which surgical resection was performed, 15 8% were malignant. It is the author's opinion that there is not enough histologic evidence to warrant a conclusion that many carcinomas develop from a benign gastric ulcer, and it is improbable that such an origin accounts for more than 5% of gastric cancer A more practical assumption is that an ulcerocancer may be mistaken for a benign ulcer and continuation of medical therapy may result in dangerous delay of treatment of gastric malignancy In this group the mortality following gastric re

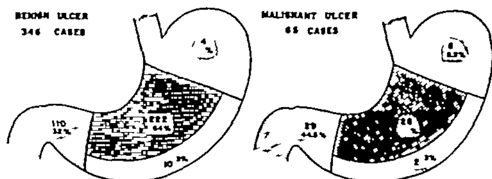


Fig 82 (left) —Benign gastric ulcer Location and percentages of benign ulcers in this series are indicated. Note 10 cases of benign ulcer on greater curvature.
Fig. 83 (right) —Malignant gastric ulcer Site of origin of group of malignant ulcers is shown. Compare percentages in these areas with those for benign ulcers. (Courtesy of Marshall S. F Ann. Surg. 13 891 903 June, 1953)

section for benign gastric ulcer was 2 2%, but the mortality from unrecognized gastric cancer is 100%

The recent onset of an ulcer large size of lesion, location on the greater curvature or prepyloric area, progressive clinical course histamine-fast achlorhydria, prepyloric obstruction and persistent occult blood in the stool with increase in the size of the lesion during treatment are strong evidences of the possibility of malignant degeneration or of presence of ulcerocancer Although there are many pathognomonic signs of malignant disease in an ulcerating gastric lesion there are no pathognomonic criteria that an ulcer is benign. Gastric ulcers have occurred at the Lahey Clinic in the ratio of 1 gastric ulcer to 12 duodenal ulcers. Carcinoma is less likely to develop in patients with duodenal ulcer and coexistent gastric ulcer than in those who had no stomach disease The sex ratio in benign ulcer was 2 7

males to 1 female and with malignant ulcer 2 8 to 1 The location of the ulcers is shown in Figures 82 and 83

Patients undergoing medical therapy for gastric ulcer should be hospitalized and, after a period of well controlled medical therapy, they should become symptom free, the ulcer should decrease progressively in size, there should be absence of occult blood in the stools, and examinations with the x ray and gastroscopy should show that the ulcer is completely epithelialized If the ulcer fails to heal or recurs or if malignant disease is impossible to exclude operation should be performed as soon as possible, in most cases this should be gastric resection, providing the patient's condition permits

Routine surgical treatment of all cases of uncomplicated gastric ulcer is not recommended and is undesirable, in a considerable percentage of cases it cannot be regarded as a prophylactic measure against development of carcinoma. Although immediate operation in every case of gastric ulcer is not advocated, Marshall feels that a higher percentage, probably 50% or more, of chronic gastric ulcers should be resected since an appreciable number have been found at operation to be malignant Temporizing with a nonhealing ulcerating lesion of the stomach involves serious risk to the patient and is completely unjustified

Gastric Ulcer and Gastric Cancer I S Ravdin and Robert C Horn, Jr,[2] (Univ of Pennsylvania) state that gastric resection is at present the only therapeutic method which offers hope in gastric cancer Results are best when the malignancy is *limited to the stomach and has not extended* to a single perigastric node under these circumstances hope for five year survival is approximately 50%

It is frequently impossible to distinguish between a benign and a malignant gastric ulcer Roentgen evidence of healing is of limited diagnostic value since in certain instances such a circumstance is associated with actively growing cancer cells filling a previously demonstrated crater All too often gastroenterologists and internists indicate to the patient that it is safe to try several periods of medical therapy because they are reasonably sure that the lesion is benign

(2) Ann. Surg 137:904 910 June 1953.

despite the fact that the most experienced gastrointestinal surgeon is very often unable to tell with accuracy whether the lesion is benign or malignant even after he has exposed and palpated the lesion.

Most (77%) gastric ulcerations, benign or malignant, occurred on or involved the lesser curvature of the stomach. One fifth of gastric ulcers are malignant no matter where they occur Of 44 instances in which the preoperative diagnosis was carcinoma, the diagnosis was established as cancer in only 19 (43%) Of 99 patients who were operated on with the presumptive diagnosis of gastric ulcer, 11% subsequently proved to have carcinoma of the stomach. In others, an ulcer thought to be in the duodenum was found in the stomach at operation

Because cancer may eventually develop in 10% of benign gastric ulcer patients and because of the diagnostic errors and prolonged medical trials the authors believe that gastric ulcer should be regarded primarily as a problem for the surgeon, provided radical gastric resection can be performed with a satisfactorily small operative risk. The operation performed should as a rule be the same with respect to the omenta as that followed for known cancer They are convinced that the answer to gastric cancer is not total gastrectomy but the earliest removal possible of neoplasms which may become cancer the radical resection of all gastric ulcerations when they are diagnosed and, when these objectives have not taken place radical excision of gastric cancer before metastasis has occurred.

Only by continually pointing out the more satisfactory survival rates when the cancer is still limited to a small portion of the stomach without lymph node metastases can the statement be offset that the prognosis *of gastric cancer* is so bad that the few weeks' or even months' delay occasioned by trial of medical therapy really makes no difference in the ultimate outcome

At the Hospital of the University of Pennsylvania patients with gastric ulcer are now sent to the surgeon It is the only way that the end results of gastric cancer can be improved If serial sections are cut through these ulcers the early cancers will be found The end results of gastric

cancer can be improved without total gastrectomies or anything else except a radical resection in the early stages of gastric carcinoma. The authors are operating on every one of the gastric ulcer patients sent to them

Pain in Chronic Gastric Ulcer Basic Anatomy and Mechanism. Using local anesthesia to anesthetize the abdominal wall and stomach, V J Kinsella[3] (Sydney) studied the pain sensitivity of the stomach and believes that pain from ulcer of the stomach, like pain from ulcer of the leg, is due to stimulation of nerves in the inflamed tissues, by rise in local tissue tension and by irritating chemical changes. Studies were made of 22 gastric ulcers removed by partial gastrectomy Both rolled-edge and sloped edge ulcers were seen, the gaps bridged by the four layers of Askanazy, the leukofibrinous innermost, then the eosinophil necrotic, the granulation and the fibrotic

The nerves form two groups, those of the edge and those of the gap The nerves of the edge belong to the myogastric and submucous plexuses They are embedded and sealed off in the anatomic layers and are inaccessible to intragastric acid. They are two to three times more numerous and larger than normal, forming "end bulbs" akin to those in an amputation stump The nerves of the gap are inconstant and when present are embedded in the pathologic layers. Their destruction is more gradual The nerves are destroyed before the floor of the ulcer reaches them and their remnants are separated from the gastric contents by layers insensible to acid.

Ulcer *pains are due directly to inflammation and neither* acid nor ulcer is necessary for their production The ulcer itself in its full thickness is the chief site of pain. The pain due to inflammation fluctuates with local hemodynamics, the most striking fluctuation being the relief which follows food This causes, through increased function, decreased vascular pressure and relaxation of postural tone Alkalis open the surrounding vascular stream bed by increasing secretion and therefore blood supply and by relaxing the postural tone Acid may cause pain by increasing the tone in the tender area Although motor activity, including

(3) Lancet 2 353 361 Aug. 22 1953

spasm, is not the primary cause of ulcer pain, if excessive it may cause pain by squeezing tender tissue Waxing and waning of ulcer pain and exacerbations before hemorrhage or perforation are due to acute exacerbations of the chronic inflammation.

The hypothesis that acid acting on nerve endings causes pain is untenable as it ignores gastric pain with achlorhydria, with deep narrow ulcers admitting no acid, antrum gastritis, exacerbation before hemorrhage and perforation, and seasonal variation in pain Many patients with ulcer pain have no nerves in the ulcer floor some have no acid and some even have no ulcer

[This very interesting study should come to the attention of all those interested in both the physiologic and clinical aspects of gastric ulcer —Ed.]

Vagotomy as a Prophylactic and Curative Procedure in Peptic Ulcer According to Waltman Walters and Donald P Chance[4] (Mayo Clinic) vagotomy is not indicated in treatment of gastric ulcer since partial gastrectomy gives excellent results, has only a 2% operative risk and ulceration never recurs Evaluation of vagotomy, therefore should be confined to use in duodenal ulcer

To provide a basis of comparison it is noted that gastroenterostomy was performed extensively in the twenties for duodenal ulcer The operative risk was 1% or less and the recurrence rate 4-6% Gastric resection was later used, with 90% excellent results, a 2% recurrence rate and a hospital mortality of 1.5%

Vagotomy alone has given excellent results in only 64% with failure to heal or recurrence in 16% The results would perhaps be better if all the vagi could be cut with more certainty and if there were a more accurate test of completeness of vagotomy than is available in the insulin test.

Adding vagotomy to gastroenterostomy not only has failed to reduce the incidence of recurring ulceration but has produced motility disturbances such as nausea, fulness and diarrhea in 10-17% The risk of gastroenterostomy with vagotomy and the risk of gastric resection for duodenal ulcer are similar Vagotomy plus pyloroplasty has largely

(4) J.A.M.A. 153:993-997 Nov 14 1953

been abandoned in favor of gastroenterostomy and vagotomy

Vagotomy is a great contribution to the treatment of recurring ulcer, especially after gastric resection. Healing of the ulcer occurred after vagotomy in 70 5% of 78 cases of gastrojejunal ulcer after gastrectomy and in 77 8% of 27 cases in which the ulcer followed gastroenterostomy Gastric resection alone gave excellent results in 86 5% of 111 cases of gastrojejunal ulcer after gastroenterostomy Vagotomy in these cases, however, has only a 1% operative risk and produces a far better result than another gastric resection

Except in selected cases, simultaneous vagotomy and gastric resection are not performed at the Mayo Clinic because of the persistent troublesome disturbances in motility and because of the low recurrence rate of 2% after gastric resection alone Vagotomy combined with gastroenterostomy has been used for middle aged men with high concentrations of acid and large duodenal ulcers when the risk of removal or of allowing the ulcer to remain as a part of a gastric resection was high

Experimental Assay of Operative Procedures Used Clinically for Peptic Ulcer Edmund A. Kanar and Henry N Harkins[5] (Univ of Washington) investigated the ulcerogenic potencies of the three phases of gastric secretion in 58 dogs through use of a new operative preparation. The dogs were prepared by four different methods (1) three phase (cephalic hormonal intestinal) total parietal cell pouch drained by a peristaltic jejunal fistula into the duodenum, (2) two phase (hormonal intestinal) total parietal cell pouch drained by a peristaltic jejunal fistula into the duodenum and the vagus divided (3) two phase (cephalic intestinal) total parietal cell pouch drained by a peristaltic jejunal fistula into the duodenum and the antrum excised with continuity of the food passage established by cardioduodenostomy and (4) one phase (intestinal) total parietal cell pouch drained by a peristaltic jejunal fistula into the duodenum with the antrum excised and the vagus divided In group 1,

(5) West. J Surg 61 6 9-65- December 1953

100% of the dogs had ulcers and the average survival was 40 days, in group 2, 100% of the dogs had ulcers and the average survival was 59 days, in group 3, 45% of dogs had ulcers and the average survival was 76 days, and in group 4, 5% of dogs had ulcers and the average survival was 33 days The study indicates that the antral phase of gastric *secretion is the most significant in the production of peptic* ulceration in dogs

The effects of gastrojejunostomy alone and of vagotomy with and without gastrojejunostomy on the chemical phase of gastric secretion were quantitatively determined Gastrojejunostomy of the main stomach in 11 dogs produced an average increase of 97 3% in the free HCl output of a denervated (Heidenhain) gastric pouch. Vagotomy of the main stomach in 11 dogs resulted in an average increase of 226% in the free HCl output of a similarly denervated gastric pouch. Supplementary gastrojejunostomy of the vagotomized stomachs in five animals gave an inconstant change in Heidenhain pouch secretion and failed to return to free HCl output to the prevagotomy levels

The increase in the hormonal phase of gastric secretion as measured by the output of the Heidenhain pouch after gastrojejunostomy to the main stomach may be due to (1) loss of part of the duodenal acid inhibition of gastric secretion due to diversion of the acid chyme away from the duodenum, (2) increased antral stimulation resulting from repetitious passage of food through the duodenum and afferent limb of the intestinal loop back into the stomach, (3) increased regurgitation of alkaline duodenal juices into the stomach via the gastrojejunostomy causing an increased output of HCl to maintain a constant acidity in the stomach, and (4) prolongation or intensification of the intestinal phase Further studies are being conducted to determine the exact mechanism

Subtotal *Gastrectomy for* Duodenal Ulcer Report of 46 Consecutive Cases Pacifico C Yap and Leon Sabas[6] (Univ of Santo Tomas) operated on 46 men, aged 27-56 (average 30), most of whom had symptoms of duodenal ulcer for 10-20 years. Indications for surgery were intractable ulcer

(6) Philippine J Surg 8 95-100 September 1953

(25 cases), obstruction (11), hemorrhage (5) and acute perforation (5) Preoperative preparation included correction of fluid and electrolyte imbalances, complete blood, urine and stool examinations, x ray of chest and gallbladder, ECG study and blood chemistry when indicated A Levin tube was inserted the morning of operation. Spinal anesthesia was used. All patients had a three fourth or four fifth resection of the stomach On most, a retrocolic, Polya operation was done, with exclusion of the ulcer

There was no mortality Postoperative management included use of fluids, electrolytes, gastric aspiration and vitamins Early ambulation was encouraged. Most patients had an uneventful postoperative course One patient was operated on for an acute perforation of either the duodenal stump or the excluded ulcer Follow up study of two months to five years revealed that 41 patients had satisfactory results and 1 an unsatisfactory result, 2 died of unrelated diseases, and 1 was lost to follow up It is concluded that three fourth or four fifth subtotal gastrectomy is the operation of choice for chronic duodenal ulcer Removal of the ulcer is desirable but not absolutely necessary

Sequelae of Gastrectomy K. Bowman[7] investigated, by roentgen studies, the relationship between gastric emptying and the time of dumping syndrome in patients who have had Billroth II operations with retrocolic gastroenterostomy

The first symptoms appeared soon after the stomach began to empty its contents In some patients, as food passed through the bowel, subjective disturbances increased simultaneously with a 10-30 mm. drop in blood pressure and a 20-30% increase in pulse rate These disturbances subsided gradually but recurred sometimes when the stomach was empty Some patients had regurgitation or vomiting of bile

Increased demands on the bowel's digestive work, from the presence of undigested food, cause congestion of blood in the abdominal viscera The resulting disturbances, which are similar to symptoms of shock, diminish or disappear when the patient lies down.

The so-called late dumping syndrome is relieved by bili

(7) Acta chir scandinav 105 424-4 9 1953

ary vomiting which empties the stomach. The afferent loop in a Billroth II operation may behave as a temporary closed loop which empties retained bile and pancreatic juice only after the stomach is empty Simultaneous study of gallbladder function showed a *powerful contraction of the gall bladder* after the stomach was empty in some patients. There may be hypoglycemia, which is relieved by ingestion of carbohydrates. Most patients have a permanent and generalized feeling of discomfort and lack of appetite and aversion to all food after gastrectomies, which is difficult to overcome Achlorhydria and changes in the gastrointestinal flora are factors in the origin of the aforementioned troubles

One concern of dietetic treatment for the dumping syndrome is to identify and avoid foodstuffs that are most likely to cause symptoms The patient is permitted to eat just what suits him Milk, cream, eggs and sweets are usually badly tolerated, a fact which should be stressed to the patients The more ambulant the patient and the more he drinks with and after meals the sooner these disorders pass. However, when subjective disturbances do occur they are often severe Bordeaux type wines, because of their appetizing stimulating and astringent qualities, are a suitable mealtime drink for many patients and also a real medicine Medicines which prevent drop in blood pressure and counteract the tired feeling following meals usually have good effect in patients with severe dumping Antihistamines have a prompt effect on the stomach's intolerance to bile and duodenal contents

Debility with concomitant tendency to infections is a serious complication. The cause is deteriorated digestive ability in connection with a constitutional asthenia and a possible adrenal insufficiency Calcium deficiency is probably common

[This work is both interesting and important because it is the first x-ray study of the so-called "dumping" syndrome to be reported.—Ed.]

Side-to-Side Intestinal Anastomosis Complicated by Ulceration, Dilatation and Anemia Physiologically Unsound Procedure D Kay Clawson[8] (Stanford Univ) reviews the literature and presents a case The chief complaints of patients in order of frequency are given in the literature as (1) crampy abdominal pain, (2) tiredness, (3) nausea, (4) distention or a mass, (5) episodes of diarrhea, (6) weakness

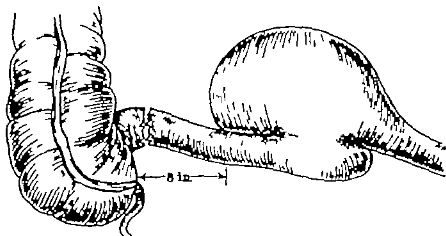


Fig 64 —Marked dilatation of proximal loop Stippled area denotes ulceration site (scale 0.5 cm. = 1 cm) (Courtesy of Clawson, D K. Surgery 34: 54 257 August 1953)

and (7) inability to gain weight The tiredness is associated with anemia, usually macrocytic

Boy, 14, was hospitalized after having lethargy for one month At age 4 he had had approximately 9 in of ileum resected from a point 20 in above the ileocecal valve for a huge bleeding hemangioma. A side-to-side anastomosis, approximately 7 cm., was done He had been well until onset of the present illness.

The hemoglobin level was 8.5 Gm./100 cc., packed cell volume 29%, mean corpuscular volume 65 μ., mean corpuscular hemoglobin 19 μμ and mean corpuscular hemoglobin concentration 29% There was occult blood in the stool. Barium enema and gastrointestinal x rays showed a large area in the right lower quadrant which appeared to be filled by at least one and possibly two widely dilated loops of bowel Laparotomy was performed after transfusion of

(8) Surgery 34 54 57 August, 1953

1,500 cc. blood. There was no recurrent hemangioma At the site of the anastomosis the proximal limb was greatly dilated and the distal limb normal The anastomosis was patent, the opening 3-4 in. long The anastomosis was resected with approximately 3 in. of small bowel on each side, and an end to-end anastomosis was performed (Fig 84) The specimen showed large marginal ulcerations. Post operative course was uneventful.

There is overwhelming evidence in favor of end to-end anastomosis as the most physiologic operation

[The information contained in this article has been well known for a long time.—Ed.]

Massive Resection of Small Intestine Six Year Follow up Study is presented by Jacob K. Berman, Elmer D Ha begger and Elmer Billings[9] (Indianapolis Gen'l Hosp)

In a woman, 51, the cecum 10 cm of the ascending colon and the entire small intestine (530 cm) except for the duodenum and 45 7 cm. of the jejunum were resected in 1947 because of thrombosis of the superior mesenteric artery with massive infarction of the in testine An end to-side anastomosis was made between the proximal jejunum and the hepatic flexure of the colon. After surgery she complained of frequent stools, gastric distention, flatulence and weakness Stools averaged 12 15/day and caused rectal irritation, tenesmus and anal discomfort Weight decreased from a preopera tive 200 lb to between 146 and 160 lb In 1948 she was found to have anemia and a megaloblastic bone marrow but no free acid in gastric contents. In 1950 she was hospitalized because of extreme weakness, extreme diarrhea rectal irritation and soreness of her tongue Blood pressure at that time was 140/90 as against 270/150 preoperatively Because of the megaloblastic condition of the sternal marrow, the absence of free acid in the gastric juice anemia and severe glossitis and weakness, pernicious anemia or at least a macro-cytic anemia due to nonabsorption of food was suspected. She was given 5 μg vitamin B_{12} intramuscularly Improvement was remark able stools assumed normal consistency and were reduced to four or five a day Rectal irritation disappeared, and the blood picture returned to normal Gastric analysis with histamine stimulation in 1952 ruled out pernicious anemia. Macrocytic anemia due to mal nutrition based on poor absorption of food was diagnosed. After the correction of anemia, the blood pressure rose to 200/100

This is believed to be the first case of macrocytic anemia reported after massive resection of the small intestine

Leakage and Reflux in Ureterointestinal Anastomosis I. Free Peritoneal Graft. Frank Hinman, Jr[1] (Univ of California) attempted to decrease chances of leakage and reflux

(9) Am. J Digest. Dis 20 152 156 June 1953
(1) J Urol 70 419-425 September 1953

by applying a free graft of parietal peritoneum directly over the site of implantation A 2 × 2 cm square of parietal peritoneum with or without fascia was excised from the edge of the wound, perforated at the center and threaded over the stay suture so that the peritoneal surface was toward the ureteral tip After completion of anastomosis, the flap was drawn down to cover the suture line

Thin peritoneal grafts excised from below the linea semicircularis and placed without suture fixation were least efficient in three instances of leakage and one of severe renal infection among eight anastomoses in the dog Fixation by suture increased the efficiency in one case of leakage and one of severe infection among five anastomoses Full thickness sutured grafts, taken with the fascia of the posterior rectus sheath from above the linea semicircularis, proved most efficient in seven anastomoses with no leakages and with only two instances of cortical abscesses Fixation with thrombin, used twice, resulted in firm adhesion without serious reaction

In an experimental control series of 28 mucosa-to-mucosa transplants, there were leakage in 2, mild obstruction in 4 and severe infection in 4 The peritoneal graft, although theoretically advantageous, is not significantly superior in experimental anastomosis, nor better than clinical serosa-to-serosa reinforcement Free grafts should be reserved for cases in which insecure anastomosis cannot be reinforced by sutures or effectively implanted in a tunnel

Treatment of Irreducible Intussusception. J D T Jones[2] (Royal Victoria Infirm , Newcastle upon Tyne) presents a method of resection and early restoration of bowel continuity With a safe method of resection the surgeon is more inclined to operate before the child has been intoxicated by the squeezing of infected material into the circulation. Nine patients were treated by this method and one died During the same period 82 patients with reducible intussusception were treated by operative reduction with no deaths.

Though delay in diagnosis is a factor in irreducibility, cases with a fixed colon become irreducible at an early stage as the mesentery of the entering bowel becomes obstructed

(2) Brit. M J 2 1304-1306 Dec. 12 1953

and edema and congestion result Diagnostic barium enemas are not recommended

TECHNIC.—Through a right, paramedian, rectus-splitting incision, under nitrous oxide-ether anesthesia, as much reduction as possible is done intraperitoneally The mass is then withdrawn from the abdomen and compressed with warm saline packs to reduce edema and congestion If reduction fails or if the bowel is obviously necrotic or gangrenous, resection is performed in the usual way The abdomen is closed around the two adjacent limbs of the exteriorized loop which is excised after bowel clamps are applied and the wound protected. A small Paul tube is tied into each of the open bowel ends At 48 hours a ligature is tied around each limb of bowel between the Paul tube and skin and the bowel cut across just beyond this ligature Bowel and skin are cleansed and the abdomen is reopened The terminal inch of edematous, friable bowel is removed from each limb and continuity is re-established by side-to-side anastomosis. The abdomen is closed in layers.

Decompression of the bowel for 48 hours improves tone, reduces edema and congestion and makes it better able to hold sutures. The two stage operation has a minimal effect on the child and defers anastomosis until the child is better able to stand it The "spur" type of double barreled enterostomy is not used because of occasional difficulties in closure with consequent delay in re-establishing normal bowel function

Ischemic necrosis of the ensheathing layer occurred twice and the possibility of this occurrence is a factor influencing the choice of 48 hours as the optimal time between stages. Delay may be associated with perforation of a necrotic area by peritoneal infection Careful pre and postoperative management is necessary

Results of Treatment in Acute Small Bowel Obstruction Clinical Study of 205 Consecutive Cases is reported by John A. Bollinger (St Francis Hosp Evanston, Ill.) and Edson F Fowler[3] (Univ of Illinois) Postoperative adhesions were responsible for obstruction in 41% of cases, congenital defects for 38% neoplasms for 5 9% gallstones for 2 4% and regional enteritis for 2% In 33.2% of cases there was some degree of strangulation

Intestinal decompression is an important factor in reducing the mortality rate of intestinal obstruction but if used

(3) A.M.A. Arch. Surg 66 888 904 June 1953

improperly it may actually increase the over all rate If benefit is to be derived from decompression it should be evident within 24 hours, and if definite improvement is not obtained within this period, one should usually resort to operation The earliest signs of impending gangrene which contraindicate further conservative therapy are increased pain or abdominal tenderness, increased pulse rate or development of a mass Signs which appear later are largely those of peritonitis

In 64 cases intestinal intubation was attempted as definitive therapy, and although the tube was passed beyond the pylorus in over 80%, it was successful in relieving the obstruction in only 30 (46 7%) There was an over all mortality of 9 4% In the 34 cases in which decompression was unsuccessful there was no mortality when therapy was limited to 24 hours, decompression for 24-48 hours resulted in a mortality of 11.1% and for over 48 hours in a mortality of 33 3% (over all mortality, 17 1%) Immediate surgery was performed in 133 cases (64 9% of all cases of small bowel obstructions) with a mortality of 8 3% When the 34 cases in which decompression was unsuccessful are included with those in which immediate surgery was done, the surgical mortality was 10 1% Since the primary surgical mortality is less than the ultimate mortality in cases in which decompression was continued for more than 24 hours, decompression should never be continued for longer than 24 hours in the absence of relief from obstruction

The mortality rate in small bowel obstruction due to mesenteric thrombosis was 75%, in obstruction due to neoplasms, 33%, and in obstruction due to congenital defects, 11% Closed loop obstruction occurred in 10% of cases and resulted in a 27 3% mortality

The over all mortality rate of small bowel obstruction has fallen from 14% in 1945 to 6 6% in 1951 Postoperative complications have diminished from 29 6% in 1945 to 13 1% in 1951.

The over all mortality rate of small bowel obstruction can probably be decreased to below 5% by earlier diagnosis of strangulation and by limiting unsuccessful decompression to 24 hours

Vital Staining of Lymphatics in Surgery of Carcinoma of Large Intestine Joseph Weinberg and Herbert J Movius[4] (Long Beach, Calif.) have greatly reduced the difficulties of resection in carcinoma of the large intestine by staining the lymphatics with direct sky blue dye in 4% solution in distilled water at the time of surgery As soon as the abdomen is opened, 3 5 cc of the dye is injected into the intestinal wall immediately distal and proximal to the tumor dissection is delayed 15 minutes, to allow the nodes gradually to stain a vivid blue

Uptake of the dye may be limited by tumor blockage If a node is partly invaded by cancer, only normal tissue stains *Local edema or fibrotic changes or both sometimes* interfere with passage of dye to distant nodes

Submucosal staining in the direction of the circumference of the bowel is more extensive and rapid than in the long axis In the latter direction, the dye usually stains not more than 2 cm. on each side of the area of injection. Lymph channels which run parallel and close to the mesenteric or parietal wall attachment are sometimes seen to extend as much as 5 cm in a proximal or distal direction or both to reach the paracolic nodes

With the use of this dye the ideal of adequate regional lymphatic dissection is more nearly approached

[Seems like a good procedure.—Ed.]

Routine Sigmoidoscopy for Early Detection of Rectal Carcinoma According to Bengt J E Ihre[5] (Stockholm) carcinoma of the colon and rectum is the fourth most common variety of malignant tumor found in women, and its frequency in men is surpassed only by carcinoma of the stomach. More than 50% of these tumors are localized to the rectum and anus Of 1 920 routine sigmoidoscopies done on hospital and private patients from March 1950 to October 1952, 143 revealed polyps Most patients were over age 40

(4) Am Pract & Digest Treat. 5 183 March, 1954
(5) Gastroenterologia 79 347 354 June 1953

The polyps varied in size from that of a grain of rice to that of a bean and were commoner in men than in women Extirpation and histologic examination were done in 70 cases, and in 13 the polyp was precancerous or a fully developed adenocarcinoma Malignant degeneration was found in eight men and five women In some cases malignant changes were present only in the head of the polyp, where as in others they involved the pedicle Some polyps were too small for biopsy and electrocoagulation was done Most polyps were within 15 cm from the anus However, polyps, even malignant ones, have been found up to 24 cm from the anus

X ray examination alone will not reveal all colonic carcinomas, and sigmoidoscopy is necessary, especially for detection of small polyps. Every polyp should be regarded as a potential cancer menace and removed

[Undoubtedly routine sigmoidoscopy will reveal unsuspected polyps, as has been shown in many studies. The author is probably wrong, however in his statement that carcinoma of the colon and rectum in men is surpassed in frequency only by carcinoma of the stomach. At least in the United States, bronchogenic carcinoma has become the most common carcinoma in men.—Ed.]

Congenital Megacolon. Orvar Swenson[6] (Tufts College) divides children with constipation into two groups those with chronic constipation of a habit or psychologic nature, who should be treated medically, those with congenital megacolon, who should be treated surgically Children with megacolon have serious constipation from birth which may be so prominent that intestinal obstruction is diagnosed in the first days of life and exploration performed. A considerable number die in the first weeks of life, the rest have varying degrees of constipation with intermittent distention and require enemas or other aid in evacuation. Children with habit constipation have no symptoms until they are 2 or 3, and abdominal distention is rare

Children with congenital megacolon have abdominal distention and increased anteroposterior chest diameter with superior and lateral flaring of the rib margins There is often a fecal impaction which cannot be palpated on rectal examination, indicating the impaction is above the congeni

(6) Pediatrics 1: 1-4 July 1953

tal lesion. Those with chronic constipation have no distention or deformity and fecal impaction can always be felt on rectal examination, indicating the absence of a congenital lesion in the lower colon

Diagnosis of congenital megacolon can only be made by x ray examination. There must be definite evidence of a segment of nondistended colon extending from anus to rectosigmoid. Proximal to this the sigmoid is dilated. Narrow areas 2-3 cm long in the sigmoid and rectosigmoid are usually artefacts. With the patient in lateral or oblique position, the contrast medium is allowed to flow in slowly and is stopped as the sigmoid begins to fill. This avoids overlapping which may obscure the lesion When the diagnosis is established, complete resection of the aganglionic portion of the colon should be done

There has been one recurrence in 108 patients In that instance there was incomplete resection of the aganglionic bowel To guard against such recurrence, frozen sections are made at operation to determine that ganglion cells are present at the proximal line of resection. Abdominal contour is normal one year after operation. Barium enema examinations demonstrate that the dilated bowel returns to normal size

[This method of treating Hirschsprung s disease is a contribution of great value.—Ed.]

Congenital Megacolon Comparison of Spastic and Hypertrophied Segments with Respect to Cholinesterase Activities and Sensitivities to Acetylcholine, DFP and Barium Ion Kazuya Kamijo Robert B Hiatt and George B Koelle[7] (Columbia Univ) attempted to determine whether any changes in the levels of specific or nonspecific cholinesterase (ChE) activity of the bowel wall might accompany structural changes and physiologic abnormalities of congenital megacolon and to ascertain the effects of any such deviations on the response of the smooth muscle fibers to acetylcholine (ACh) and an anti ChE drug

METHODS —A segment of tenial longitudinal muscle was cut from the spastic and the dilated region of five surgical specimens. The segments were suspended in Tyrode solution through which 95% O_2 and 5% CO_2 was bubbled. Thresholds of response were determined

(7) Gastroenterology 24 173 185 June 1953

to ACh, barium chloride ($BaCl_2$) and DFP (di isopropylfluorophosphate) Cholinesterase activities were determined with the Warburg apparatus. Relative sensitivities of specific and nonspecific ChE activities of the human bowel to DFP were determined by adding various concentrations to the reaction mixtures Sections were cut on the freezing microtome, transferred to slides and subjected to treatment with acetylthiocholine and butyrylthiocholine for localization of specific and nonspecific ChE activity respectively Similar studies were carried out on sections from various levels on a specimen from a case of ulcerative colitis and on a segment of normal colon with a carcinomatous region

The hypertrophied segments had lower thresholds of response to ACh whereas the thresholds of the two types of segment to DFP and $BaCl_2$ were practically identical in all cases. This indicates that $BaCl_2$ acts directly on the smooth muscle fibers of the human colon rather than on the ganglion cells

Both specific and nonspecific ChE activities were considerably higher in spastic than in hypertrophied portions Histochemical studies indicated that the greater specific ChE activity of the former was associated with the large number of nonmyelinated nerve fibers found in the myenteric plexus The lower nonspecific ChE activity of the hypertrophied segment appeared to be the result of a thinning out of the muscularis mucosae and other regions where the enzyme is concentrated

The authors suggest that the chief anatomic abnormalities in congenital megacolon may consist of central displacement of cholinergic neurons and absence or paucity of adrenergic neurons of the myenteric plexus of the spastic distal segment.

Intra-Abdominal Torsion of Appendices Epiploicae Nathan J Saltz and George M. Saypol[8] (New York City) describe two cases Appendices epiploicae are small, fat laden pouches of peritoneum 1 15 mm. in size, arranged in longitudinal fashion in a double row along the colon close to the taeniae coli There are about 100 in the average adult, and they are most conspicuous along the transverse and sigmoid segments. There is no general agreement as to their function. Etiology of the disease is obscure The involved appendage appears as a hard, reddish black, necrotic mass, twisted on

(8) New York J Med. 53 169 1694 July 15 1953

its slender pedicle and standing out prominently from the adjacent pale yellow fat pads The process subsequently results in organized fibrinous masses which occasionally become separated from the pedicle, forming free bodies in the peritoneal cavity

Of 96 cases in the literature only 1 was diagnosed correctly preoperatively The usual diagnosis was acute appendicitis because the right lower quadrant was the most common site of pain, left lower quadrant was next.

Boy, 12, complained of right lower quadrant pain of 12 hours duration. The pain was constant and increasingly severe. There was no nausea or vomiting The patient was obese. There were moderate rigidity in the right lower quadrant and marked, direct and rebound tenderness in this area. Temperature was 100.2 F White blood cell count revealed 13,000 leukocytes with 79% neutrophils. Diagnosis was acute appendicitis At operation there was a moderate amount of clear fluid. Appendix was normal and there was no Meckel's diverticulum. There was a round, hard, reddish black, necrotic epiploic appendage, about 2.5 cm. in diameter, hanging on a long, slender pedicle from the proximal half of the transverse colon. The pedicle was twisted on itself many times. The appendage and appendix were removed Postoperative course was uneventful. Diagnosis was hemorrhagic infarction of epiploic appendage.

There are no pathognomonic features. The condition occurs most commonly between age 20 and 60 with no predilection for sex Nausea, or nausea and vomiting, occurs in only 50% of the patients Although the process is relatively benign, insufficient distinguishing characteristics make abdominal exploration mandatory

Surgical Aspects of Diverticulitis Frank Glenn and Charles S Harrison[9] (New York Hosp Cornell Med. Center) report on diverticulitis in 59 men and 48 women during 1947-51 average age was 60 2 years. In group I (80 patients) diverticulitis was the secondary diagnosis with other disease primary only 12 had had symptoms that could reasonably be related to diverticulitis, namely, vague abdominal pain, severe constipation, and diarrhea with or without abdominal pain Diagnosis was made by x ray in all but one patient All were treated with low residue diet and mineral oil and, of the 23 followed, 87% had no complaints referable to the large bowel.

(9) Rev Gastroenterol. 20 643-655 September 1953.

In group II (31 patients) the diverticulitis was treated conservatively, in each, the diverticulitis was acute, and 87% gave short histories of abdominal pain, with or without diarrhea, constipation or rectal bleeding Grossly, the stools were bloody in 22%, all but 2 had abdominal tenderness, none had obstruction and, in 29, the sigmoid was involved Diagnosis was confirmed by x ray Treatment consisted of nothing by mouth and fluids parenterally for a few days with gradual advancement from fluid to low residue diet, as the acute inflammatory process subsided, and mineral oil. Antibiotics were given to most patients. Of 24 followed for more than six months, 70 8% had no symptoms referable to the large bowel.

In group III (12 patients) emergency surgery was performed within 48 hours of hospitalization Acute symptoms lasted an average 3½ days, all had abdominal pains and cramps, and average white blood cell count was 16,600 All but two had abdominal tenderness, seven had rectal pain and three had palpable masses. Of the 12 patients, 9 had colostomies (one death), and three had exploratory laparotomy with drainage Among the eight survivors of colostomy, the inflamed segment of bowel was resected in six after the inflammation had subsided The average interval between colostomy and resection was 3½ months One post resection fatality resulted from thrombosis of the superior mesenteric artery All but one of eight patients followed have done well

In group IV, 29 patients—most of them with chronic abdominal pain, urinary complaints, rectal bleeding and constipation, diarrhea, or both—underwent elective surgery, 16 had acute symptoms within a month of surgery The primary procedure in 15 was transverse colostomy, in 6, sigmoid resection, in 2, exploratory laparotomy with drainage of pelvic abscesses, and, in 1 each, left hemocolectomy, sigmoid resection and excision of a fecal fistula, exploratory laparotomy with revision of the sigmoidostomy, sigmoid resection with excision of vesicosigmoid fistula, and exploratory laparotomy with resection of a small part of the bladder No deaths occurred during operation. Such secondary procedures as resection closure of the colostomy and ex

cision of a fistula were carried out in 17 A third operation was necessary in 10 patients, and a fourth operation in 2 others Two of the 28 patients followed died of other diseases, 73% of the rest had no further complaints

In all, 85 operations were performed on 41 patients, with 2 postoperative deaths, and postoperative complications in 15 Of the 35 patients followed, 77 1% did well.

Pigmentation of Lips and Buccal Mucosa Associated with Intestinal Polyposis J Trengove Jones[1] (Univ of Cape Town) reports four cases

CASE 2.—Woman, 56, had intermittent abdominal pain for 12 hours and vomited twice. She was thin with graying dark hair, olive complexion and brown eyes. Typical markings were confined to the skin around the mouth and mucosa of the lips. Examination gave negative results. Symptoms subsided after 12 hours of gastric suction only to recur three days later An operation to relieve small bowel obstruction revealed early ileocolic intussusception initiated by a single pedunculated polyp in the ileum 1 in. from the ileocecal junction Four in of ileum containing the polyp and a wedge of mesentery including one hard lymph node were resected. Convalescence was uneventful The tumor contained considerable melanotic pigment.

CASE 3 —Girl, 20, had, over a period of one year, several attacks of abdominal cramps with vomiting Twice an operation was performed to reduce enterocolic intussusception. The patient, who had very fair skin, dark hair and brown eyes, had characteristic buccal pigmentation. Operation revealed a polyp 10 in. above the ileocecal junction and 4 in. of bowel containing the polyp were resected. Convalescence was uneventful Diagnosis was adenomatous polyp of the small bowel.

Pigmentation on the mucosa of the lips and around the mouth is punctate in distribution and varies from black to brown In only one patient was the pigment inside the mouth Skin lesions had been present as long as the patients could remember All polyps were single, pedunculated, in the small bowel, and presented as intussusceptions. Though the syndrome is generally thought to occur in people of dark complexion and in dark races two of these patients were fair haired and three had very fair skins No racial predominance can be established

One patient had two brothers with similar pigmentation but who by middle age had no symptoms or signs of polypo-

(1) South African M. J 27 930 932 Oct. 17 1953

sis. There is presumptive evidence in review of all recorded cases that the syndrome is familial and transmitted as a mendelian dominant. The syndrome affects both sexes and has been reported in all age groups with a predominance in the second and third decades, when it usually presents as intestinal obstruction

---

THE ANUS

Anorectoplasty for Extensive and Complicated Hemorrhoids. Too often the proctologist is consulted by irate patients complaining of malfunction of the anorectum following purported definitive surgical treatment for hemorrhoids. This malfunction stems from structural or pathologic defects of the anorectum, the end results of poorly planned or badly executed surgery or both Among late complications encountered are anal stricture fissure or ulcer, residual hemorrhoids, mucosal prolapse, pseudopolyps and enlarged tags. It is the exceptional patient in whom one finds only the three classic, primary hemorrhoids It is not unusual to find multiple lesions, and if only the larger varicosities are excised revision operations are soon necessary

Emil Granet[2] (New York City) developed a surgical technic which combines and freely applies the best features of the operations of Whitehead, Gabriel, Milligan and others. By its use all hemorrhoids and other associated complicating lesions can be removed from the anorectum with minimal morbidity, hospitalization and pain. This procedure was developed as a result of difficulty in adequate management of multiple lesions involving especially the posterior quadrant

TECHNIC.—Ideal anesthesia is afforded by caudal epidural block combined with trans-sacral infiltration of the second sacral nerves. The prone jackknife position with buttocks spread by adhesive straps provides comfortable operating conditions. The patient is examined first for the presence of a constricting pecten band. The lubricated index fingers are inserted, hooked about the sphincter and gently spread apart (Fig 85) If pectenosis is present, this thin fibrous band will limit spread of the opposed fingers. A major difference in operative procedure depends on the presence or absence

(2) Surgery 34:72-87 July 1953

of a constricted anus. Ideal exposure is attained through use of traction sutures secured over a metal ring retractor (Fig 86) With complicating posterior lesions the operation starts with a modification of Gabriel's triangular en bloc excision of these lesions. About 4 cm.

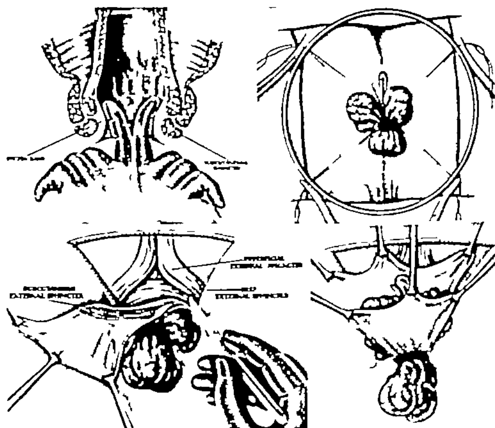


Fig. 85 (top, left) —Bidigital examination of anesthetized anorectum. Pecten band and fibrous infiltration of subcutaneous portion of external sphincter limit dilatation.

Fig. 86 (top right) —Ring retractor with traction sutures in place Excellent exposure is attained and the use of a second assistant can be dispensed with.

Fig 87 (bottom, left) —Dissection of quadrilateral flap to dentate line Fissure triad, adjacent hemorrhoids, pecten band and subcutaneous sphincter have been mobilized.

Fig. 88 (bottom, right) —Line of normal rectal mucosa well above proximal extent of diseased tissue is secured and everted. It is essential to demonstrate with this maneuver that healthy mucosa can be mobilized for later use in constructing a new dentate line.

(Courtesy of Granet E. Surgery 34 72-87 July 1953)

from the posterior anal verge, the perianal skin is incised transversely for about 4 cm., and Allis clamps are applied to aid traction From each end of the wound, incisions are directed converging toward the posterior lateral anal verge. This skin flap is dissected from the underlying subcutaneous fascia to expose the superficial and deep portions of the external sphincter muscles in their posterior aspects. As the anal verge is approached the subcutaneous por

tion of the external sphincter muscle is exposed, adherent to the skin and anoderm Anal constriction, if found, is relieved by extending the converging skin incisions boldly through the subcutaneous sphincter muscle and pecten band incorporating the posterior portion of the subcutaneous muscle in the en bloc dissection (Fig 87) About 3 cm. cephalad of all pathologic tissue, a transverse line of rectal mucosa is grasped in three Allis clamps and everted by gentle traction, demonstrating that it can be mobilized to overlie the exposed border of the deep external sphincter muscle at the level of the dentate line (Fig 88) The lateral incisions are extended to incorporate the posterolateral hemorrhoids and are continued across the anoderm and mucosa (Fig 89) By gentle blunt dissection with the scalpel handle the internal sphincter muscle is stripped from the submucosa, freeing the pedicle up to the level marked by the Allis clamps. The pedicle, containing all pathologic tissue in the posterior half of the anorectum is amputated and the branches of the superior hemorrhoidal artery in the submucosa are clamped and tied (Fig 90) The free mucosal margin is drawn externally and is sutured to the exposed distal free margin of the deep external sphincter muscle, starting at the center and proceeding laterally (Fig 91) The important feature is the formation of the anorectal margin at the level of the dentate line instead of at the cutaneous verge as Whitehead directed. The posterior skin and mucosal margin of one anterolateral hemorrhoidal mass is lifted and the underlying varicose tissue is excised by morcellation and scissor technic with a resulting bridge of redundant mucosa, anoderm and skin. One or two subdermal mattress sutures are taken near its posterior edge and are secured to the subcutaneous fascia in the lateral angle of the posterior wound. The opposite side is similarly treated. The remaining internal hemorrhoid, redundant rectal mucosa proximal thereto and the associated external hemorrhoid are grasped in three Allis clamps A small transverse incision is made in the perianal skin 2 cm. from the anal verge exposing the subcutaneous areolar fascia. Blunt dissection directed cephalad makes a line of cleavage which enters the perianal space medial to the subcutaneous external sphincter The skin and mucosa are divided close to the pedicle and the incision extended to just above the dentate line on each side. A heavy silk suture is passed through the pedicle and tied very tightly on both sides with the knot placed on the lumen (Fig 92) The pedicle is severed 5 mm. distal to the knot and drawn down into the wound to cover the denuded area and is fixed with one fine catgut suture to the subcutaneous fascia at the anal verge This pedicle sloughs out in 8-10 days, forestalling the possibility of pseudopolyp formation Morphine is ordered every three hours if necessary and its use encouraged. Daily spreading of the wound is necessary to prevent adherence and bridging

The patient is examined weekly for six weeks, the index

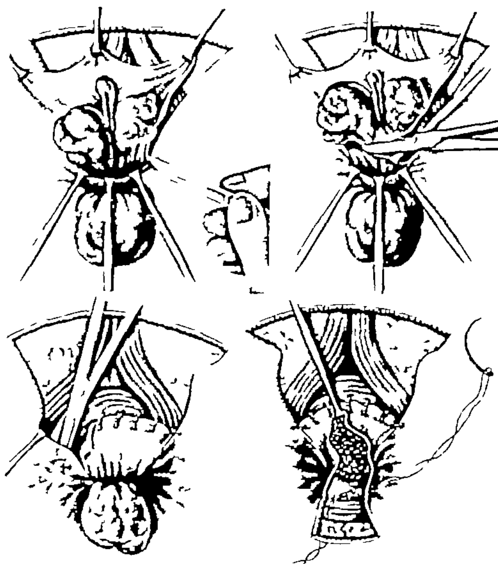


Fig 89 (top, left) —Lateral incisions are extended cephalad to include posterolateral hemorrhoids. These incisions terminate just below line of normal mucosa delineated by three Allis clamps.

Fig. 90 (top right) —Amputation of quadrilateral pedicle which contains all lesions in posterior half of anorectum. Free margin of normal mucosa is secured with a row of Allis clamps as the three anchor clamps are released.

Fig 91 (bottom, left) —Normal rectal mucosa sutured to border of deep external sphincter muscle at level of dentate line. Subepithelial morcellation and excision of anterolateral varicosities, left. Epithelial flap sutured to posterior perianal fascia forming pedicle graft, right. (From Am. J Surg 84 534 1952.)

Fig 9 (bottom, right) —Dissection of anterior hemorrhoidal mass. Transfixion of pedicle through termination of fibrous longitudinal muscle of rectum.

(Courtesy of Granet E. Surgery 34 2 8 J ly 1953)

vessels. This has not resulted in sufficient impairment of blood supply to require resection of the most distal portion of the rectum in the two patients in whom it was carried out. However, in some cases, segments of the distal rectum may have to be resected, but the length gained will more than compensate for that lost In one case in this series, because of intrinsic disease, part of the distal rectum was resected without interfering with the formation of a good anastomosis without tension.

Late results of this operation for imperforate anus in infants will depend in part on associated congenital anom alies In this series these consisted primarily of mongolism, congenital heart disease and various types of genitourinary anomalies. In all cases, the kidneys should be palpated at time of operation Pyelographic studies should be made routinely

Seven Cases of Imperforate Anus Treated by Abdominoperineal Replacement of Rectum. C C Winkel Smith[4] (Univ of Copenhagen) has classified imperforate anus into two types in group 1 cases the bowel is placed so low that operation can be carried out from below through a persist ing anal membrane or through a fistula, and in group 2 cases the bowel lies so high that combined abdominoperineal re placement of the rectum is necessary No method of exam ination can estimate exactly the distance between the skin and the bowel in group 2 patients and, since 40% have fistula to the urethra, an operation through the perineum alone is extremely dangerous and often leads to permanent damage to the anal sphincter, levator ani and urethra.

Since 1949, the author has treated 27 children with im perforate anus Six were girls with anus vestibularis, 10 were boys with imperforate anus with fistula or membrane, all of whom had good results with simple local operations, and 11 were boys with high atresia without fistula to the perineum. Of the last group four were eliminated because surgery was not done or because of poorly planned pre vious surgery

All of seven who had a combined abdominoperineal re placement of the rectum withstood the operation well. After

(4) Acta chir scandinav 105 305-310 1953

treatment with anal dilatation was carried out from the 5th or 6th day without discomfort Within two to three months instrumental dilatation was replaced by the much easier and probably better dilatation with the little finger

Anal function has been fairly good, but as the children are not over 2 years old, it is too early to estimate the real value of the operation As a whole, it is a great improvement over the simple perineal technic. No hydronephrosis could be found after the operation and no strictures of the urethra have developed postoperatively Three patients had concomitant heart disease

In uncomplicated group 2 cases, operation immediately after birth is indicated, but if there are complications it is better to make a temporary colostomy on the transverse colon until conditions are somewhat clearer

Injection Treatment of Hemorrhoids Gilbert L Wright[5] (Univ of Utah) believes that there is a place for injection therapy and that results are good if one understands and heeds the indications, contraindications and limitations of the procedure

Uncomplicated internal hemorrhoids can be treated by injection but external hemorrhoids should not be Complications such as fistula, abscess or prolapse with thrombosis are contraindications or, at least, reasons for postponing injection therapy Sometimes external hemorrhoids shrink after injection of the internal hemorrhoids If there is recurrence or development of new internal hemorrhoids, they can be treated by injection, subject to the aforementioned limitations.

Bleeding internal hemorrhoids, with no other symptoms, are the prime indication for injection therapy, and further bleeding can be prevented in almost all cases Advantages of injection are no disability painless procedure, and low cost

TECHNIC.—Proctosigmoidoscopy should be done before any treatment An anal speculum is inserted and with a straight or curved no 23 hemorrhoidal needle, the solution is injected directly into the hemorrhoidal mass, in the middle or upper portion well above the pectinate line Injection distal to this line will cause pain during and after injection. The author injects 0.5-1 cc. of 1% aqueous solu

(5) Am. Surgeon 19 799-801 August 1953

tion of sodium tetradecyl sulfate in the manner of injecting a varicose vein. A rectal dilator with a bulbous, tapered tip is inserted immediately after the injection and left in place for five minutes while the patient stays quietly on the table. The dilator prevents leakage of the solution, promotes collapse and obliteration of the hemorrhoid and helps to prevent painful spasm of the anal sphincter. Injections are made at intervals of one week, and only one hemorrhoid or at the most two are treated at each visit. From three to eight treatments are required.

Results have been almost uniformly good. Side effects are few and are usually due to low injection or to seepage of the solution down below the pectinate line.

Pilonidal Sinus: Experience with 449 Cases. This condition is generally considered congenital, either representing a remnant of the neural canal or due to ectodermal inclusion resulting from malfusion of the two halves of the body. Richard W. Dwight and Joseph K. Maloy[6] (V.A. Hosp., Boston) on the basis of experience gained from various operations on 449 patients question these concepts of etiology and doubt the necessity, commonly accepted, of removing the sinus tract except to allow primary closure in selected cases.

A 12% recurrence rate was noted in 168 patients when flaps of gluteal muscle and fascia were used to close the dead space left by excision. Incision and drainage of pilonidal abscesses through a midline incision extended to include all midline sinus openings followed by loose packing was practiced on 45 patients with three recurrences. In 48 the tracts of all chronic sinuses were laid open, hair and unhealthy granulations removed and skin edges trimmed where necessary with six recurrences. These wounds heal by filling in with granulation tissue and are indistinguishable, after a few days, from those after total excision except that the defect is smaller.

A technic of primary closure was used on 50 patients with six recurrences, performed only for midline lesions 8 cm. or less in length with no extension more than 2 cm. from the midline. This consisted of excision of the tract and openings with a minimal amount of skin and fat followed by closure in four layers with two running sutures of 000 braided

(6) New England J. Med. 249:926-930, Dec. 3, 1953.

Surgalloy wire, each starting and ending at the upper end of the wound passing through a pull out wire at the lower

The authors believe that recurrences following pilonidal sinus operations are not due to persistence of hair producing epithelium but are true recurrences due to mechanical factors caused by collection of hair in an imperfect scar and that most pilonidal sinuses develop similarly Some combination of stiff hair, tender or macerated skin, poor hygiene and repeated trauma cause initial penetration of the skin and once the opening exists loose hairs collecting in the gutter between the buttocks find their way into it forming a foreign body cyst

Also against the congenital theory of origin are (1) hair attached to follicles has never been found in the specimens examined by the authors, (2) there is a high ratio of males to females with the disease, (3) there is an association with obesity and trauma, and (4) similar lesions have been found in regions other than sacral

[This is an interesting idea. Perhaps it is correct. In my experience the surest way to accomplish healing of a pilonidal sinus is to open it widely and let it fill from the bottom with granulation tissue.—Ed.]

Pilonidal Sinus and Cyst Comparative Evaluation of Various Surgical Methods in 229 Consecutive Cases Martin J Healy, Jr., and Paul W Hoffert[7] (V.A. Hosp, Bronx, N Y) note the general agreement that pilonidal sinuses or cysts are congenital in origin The disease predominates in males in a ratio of 3 or 4 to 1 Hypertrichosis is common The lesions may be excised and closed primarily packed open and allowed to close secondarily or partially closed

In the present series, 82% of patients were aged 20-29 Average duration of symptoms was 11 7 months The usual symptom was drainage from the lesion, with or without pain In the 212 patients available for follow up, 245 operative procedures were carried out End results were rated on an anatomic, functional and economic basis

The percentage of good or excellent results varied from 77% with partial closure by MacFee s method to 87% with partial closure by the authors method which involves undercutting of skin flaps and approximation of skin to sacral

(7) Am. J Surg 8 3 8 588 April, 1954

fascia with Sturmdorf sutures tied over soft rubber tubing These figures are not significantly different from those for good or excellent results after primary closure (81%) or after excision with open packing (83%) Of 40 patients treated by incision and drainage, 43% required no subsequent therapy The shortest average hospital stay was 14.2 days for primary closure and the longest stay 25 6 days for excision and open packing Of patients with primary closure, 94% were healed on leaving the hospital, whereas 77% of those treated by open packing had an open granulating wound In each group there was an equal distribution of complicated cases The initial lesion bore no relation to the end result except that complex, clean cases showed slightly better results

Excision with primary closure is suggested whenever anatomically feasible, with partial closure technic recommended for all other cases, either being preferable to open packing

---

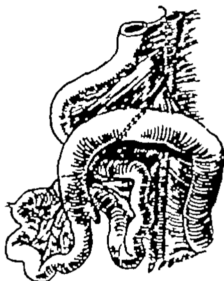
HERNIA

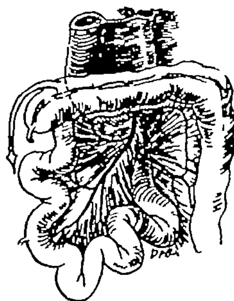
Intra-abdominal Hernias Due to Developmental and Rotational Anomalies Leo M Zimmerman and Harold Laufman[8] state that these hernias are rare Only 12 unequivocal cases were found in a 10 year survey at Cook County Hospital. The hernias are thought to arise when small bowel is trapped behind the transverse mesocolon, as the cecum rotates and becomes fixed to the posterior peritoneum The fossae in which incarcerations commonly occur are paraduodenal (including left and right paraduodenal transmesocolic and foramen of Winslow) pericecal, intersigmoid and internal supravesical

An understanding of the origin and nature of paraduodenal hernias requires a review of the embryologic stages of normal intestinal rotation (Figs 93-96) The primitive alimentary canal is a straight tube suspended from the dorsal abdominal wall by a common mesentery It becomes differentiated into fore mid and hindgut The midgut

(8) Ann. Surg 138 82 91 July 1953







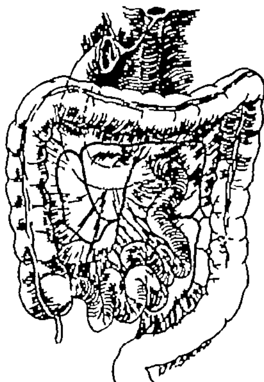


Fig. 93 (top, left).—Loop formed by midgut.
Fig. 94 (top, right).—Rotation of midgut and extracelomic position.
Fig. 95 (bottom, left).—Orderly return of intestinal loops into peritoneal cavity below transverse mesocolon and further rotation of 180 degrees counterclockwise.
Fig. 96 (bottom, right).—Descent of cecum and fixation of ascending colon to posterior parietal peritoneum.
(Courtesy of Zimmerman, L. M., and Laufman, H.: Ann. Surg. 138:5, 91, July 1953.)

elongates rapidly and is thrown into a loop This bulges through the umbilical orifice into the base of the umbilical cord and occupies this extracelomic position from the 5th to the 10th week of intrauterine life During this period the loop undergoes a 90 degree rotation, counterclockwise from a sagittal to a horizontal plane At the end of the 10th week the loop returns to the abdominal cavity and rotates an additional 180 degrees Reduction of the bowel proceeds in an orderly fashion, the proximal portion first, followed by cecum and ascending colon Subsequently the cecum descends to the right lower quadrant and the colon becomes fixed to the posterior parietal peritoneum Right paraduodenal hernia is due to delayed and incomplete rotation of the umbilical loop The cecum then does not lie superior to the small intestine and as it rotates the small bowel is caught in the mesentery of the ascending colon Left para duodenal hernia is a manifestation of a further degree of the same malformation There is a reversed rotation of the umbilical loop so that when the small bowel is reduced it is caught in the mesentery of the descending colon and eventually incarcerated there Paracecal hernias occur because of a minimal error in rotation with incarceration behind the cecum in the final phases of descent and fixation The factors held responsible for development of supravesical hernias are (1) increased depth of the fossae, due to congenitally incomplete regression of the hypogastric arteries and urachus (2) loss of prevesical fat and (3) inflammatory fibrosis of subperitoneal tissues with retraction

These hernias may be asymptomatic and discovered accidentally at operation for other causes When symptoms are produced, they are those of acute intestinal obstructions, often of the strangulating type The symptoms are not specific but roentgen findings may be characteristic with an agglomeration of small bowel into one portion of the abdomen and an absence of loops elsewhere

The primary purpose of operation is to release the obstruction This may be accomplished by gentle traction, dilatation of the hernial orifice or incision in an avascular portion of the sac with delivery of the imprisoned intestinal loops Further manipulation depends largely on the condi

tion of the bowel If feasible, the original hernial orifice should be obliterated, and artificial openings made in the mesocolon for release of strangulated intestine should also be closed

Paraduodenal Herniae in two cases, one on the right and one on the left, are described by V Ramachandra Rao[9] (Visakhapatnam, India)

CASE 1—Youth, 22, had severe abdominal pain and progressive distention He felt sudden epigastric pain eight hours before hospitalization. After he vomited twice the pain recurred periodically, increasing with each recurrence He was constipated and passed no flatus. The abdomen was distended and the abdominal wall moved freely with respirations There was over all tenderness but no rigidity of the abdominal wall Percussion note was resonant throughout and auscultation disclosed brisk peristalsis. Rectal examination showed ballooning of the rectum. Temperature was 100 F Acute intestinal obstruction was diagnosed and he was operated on. X ray had revealed distended loops of intestine suggestive of a ladder pattern. A laparotomy two-thirds of the total length of the jejuno-ileum was found to be tucked away under the hepatic flexure into what appeared to be a peritoneal recess. The intestines were pulled out and a small constriction was found where the loop emerged from the peritoneal recess. The sac was big and its opening was on the vertebral column The intestine was viable and there were a few flakes of lymph scattered over the bowel wall Interrupted catgut sutures were placed to obliterate the peritoneal recess, with care taken not to injure the superior mesenteric artery running in its anterior fold. Recovery was uneventful.

CASE 2.—Man, 31 had had postprandial abdominal pain for four years. The pain, in the right hypochondrium and epigastrium, would start about three hours after eating and was relieved only by vomiting There was no hematemesis or melena. Medical treatment had given no relief. The abdomen was scaphoid with maximal tenderness on palpation to the right of the umbilicus in the epigastric region. There was no visible peristalsis of the stomach Liver and spleen were not palpable. A fractional test meal showed that the total acid level and free HCl in the fasting and in the two hour specimens were slightly higher than normal. Barium meal and x ray revealed a deformed duodenal cap and fairly normal emptying of the stomach. Chronic duodenal ulcer was diagnosed and gastrojejunostomy was decided upon. Surgery disclosed a chronic duodenal ulcer When the jejunum was being mobilized a large left paraduodenal hernia was found with nearly 6 ft. of intestine in the sac. Review of the x rays disclosed that the half and three hour pictures should show such a possibility, not noticed on earlier examination. Adhesions at

(9) Indian J Surg 15 19 27 March, 1953

the mesenteric and antimesenteric borders of the jejunum were freed and the hernia reduced. The neck of the sac was repaired with a few cross-stitches. A posterior no-loop gastrojejunostomy was then done and the abdomen closed in layers.

Diaphragmatic Hernia through Esophageal Hiatus is common and too often unrecognized, according to P Hillemand and Watteblede[1] Hiatus hernia is by far the most wide spread form of diaphragmatic hernia of the stomach and ranks ahead of ulcer among gastric disturbances. Women of 50 or older are especially susceptible Diagnostic errors can be avoided by careful interrogation of the patient and the use of a few simple radiologic procedures designed to demonstrate small and intermittent hernias which might otherwise be overlooked Pain, the most usual symptom, is felt in the upper part of the epigastric hollow, often behind the xiphoid process and may radiate upward behind the sternum. Pain resulting from postural changes especially forward bending, is characteristic of hernial protrusion and is of great practical importance in diagnosis although individual variations must be taken into account Valuable diagnostic information is also supplied by postural heartburn that often culminates in regurgitation of acid liquid or even food, chiefly on bending forward or lying down, it may disturb sleep and usually lessens in the upright position Vomiting is rare but eructation is not, and hernia should be suspected whenever there is aerophagia. Respiratory and cardiac symptoms are seldom found Radiologic detection of small diaphragmatic hernias is facilitated by compression in procubitus which forces the barium into the upper part of the stomach and causes protrusion of intermittent hernias The position of the cardia merits careful study although sliding cardioesophageal hernias with a thoracic cardia are most common, paraesophageal hernias of the greater curvature with an abdominal cardia are also found For study of the gastroesophageal reflux, the patient swallows a few mouthfuls of water to empty the esophagus of its barium content, the decubitus position will then disclose retrograde flow into the esophagus to a level varying with the severity of the condition Pyrosis peptic esoph

(1) Presse méd. 61 886 June 20 1953

TECHNIC.—Through the left 7th interspace the pulmonary l
ment is divided, the esophagus isolated and the muscular edge
the hiatus exposed. A long clamp is directed through the under
face of the hiatus from a small incision in the dome of the



Fig 9 —Inferior surface of diaphragm. Herniation through esophageal hiatus occurs after lengthening and widening of posteroinferior part of the aperture (Court of Lam, C R and Kenney L. J ; J Thoracic Surg 27 1 12 January 1954)

phragm. A tape encircling the esophagus is grasped by this clam
and drawn out of the opening in the diaphragm as an aid in mai
taining reduction and exposure. Guided by the palpating finger, fi
or six sutures are placed, posterior to the esophagus, passing throu
all layers of the esophagus, approximating the right and left crur

Before tying of the sutures, three or more mattress sutures are placed, attaching the esophageal musculature to the under surface of the diaphragm. As the anterior suture is tied a finger is placed by the side of the esophagus to control the size of the opening. No attempt is made to excise or plicate the peritoneal sac.

This technic was used in the repair of 20 hernias with no roentgen evidence of recurrence. Dysphagia from pre-existing esophagitis in two patients was improved following dilatation. There were no deaths.

THE ADRENAL GLANDS

Adrenals of the Koala (Phascolarctos Cinereus) and Their Alleged Relationship to Eucalyptus Leaf Diet were investigated by A. Bolliger[3] (Univ. of Sydney). He found that the adrenal gland body weight ratio of three koalas was below average values for mammals in general. It is doubtful, however, if this can be interpreted as evidence of a constitutional adrenal insufficiency. Histologically, the adrenals of the native bear are of the usual mammalian pattern, and functional investigations would be required to prove or disprove such a hypothesis. There is no evidence that eucalyptus leaves contain adrenal hormone-like substances. The preference of the koala for a diet of certain eucalyptus leaves may be determined by their availability, their dietary suitability or other factors quite unrelated to adrenal function.

Phalangers or opossums, which also have small adrenals, were kept in a laboratory for several years without receiving any eucalyptus leaves, and they remained healthy. Thus the hypothesis of MacKenzie and Owen that the koala and phalanger have small adrenals because they eat eucalyptus leaves has not been proved.

[It is curious how a mistaken idea persists, such as that which assumed a nearly complete absence of adrenal gland in the koala, the prototype of the teddy bear, and that substitutes for the adrenal hormones were obtained in the diet of eucalyptus leaves. It would seem that Bolliger has put those errors to rest.—Ed.]

(3) M. J. Australia 1: 91-910, June 7, 19[illegible]

Evaluation of Adrenal Resection and Sympathectomy in 99 Persons with Hypertension William A. Jeffers, Harold A. Zintel, Joseph H. Hafkenschiel, A. Gorman Hills, Alfred M Sellers and Charles C Wolferth[4] (Univ of Pennsylvania) analyzed 99 patients after various types of sympathectomy and various degrees of adrenal resection. The following indications should be present before operation is attempted (1) average diastolic blood presure 120 mm Hg or more, (2) failure to respond to intensive medical therapy, (3) evidence of progressive damage to heart, kidneys, brain or eyes Any of the following is a contraindication (1) poor renal function with less than 20% phenolsulfonphthalein excretion 15 minutes after intravenous injection or blood urea nitrogen over 20 mg /100 ml., or both, (2) stroke or coronary occlusion less than six months ago, (3) age above 55 and (4) inability to co-operate in careful postoperative program.

Subtotal adrenalectomy, removing all of the right gland and all except a 5-6 mm cube of the left, performed either alone or in combination with Peet, Adson or Smithwick sympathectomy was done 73 times Total adrenalectomy, alone or combined with Adson or Smithwick sympathectomy was performed 26 times

An operative mortality of 8% within one month was noted. The usual cause of death was a cerebral vascular accident or a coronary occlusion. Only one died from adrenal insufficiency Improvement occurred respective to heart size in 45% ocular fundi in 45% and ECG abnormalities in 41% An excellent response was noted in 23% a fair response in 23%, a poor response in 30%, 24% died. Patients with paroxysmal dyspnea or congestive heart failure before operation showed the most striking improvement. No consistent evidence of improvement in renal function was noted as measured by phenolsulfonphthalein tests or special clearance studies.

During the first month after operation liberal cortical replacement therapy has been given including cortisone 37.5-50 mg desoxycorticosterone 2 mg and enteric sodium chloride 3-6 Gm daily Later these dosages are diminished to

(4) J.A.M.A. 153 1502 1505 Dec. 26 1953.

achieve optimal level of blood pressure while avoiding anorexia, nausea or hyperkalemia.

Further observation is necessary to prove which operation is superior Operations of this sort cannot be attempted without a well integrated medical and surgical team prepared to deal not only with all surgical complications but with any of the manifestations of severe hypertensive cardiovascular disease or adrenal insufficiency

Postoperative Adrenal Cortical Insufficiency Occurrence in Patients Previously Treated with Cortisone is described by Robert M. Salassa, Warren A Bennett, F Raymond Keating, Jr., and Randall G Sprague[5] (Mayo Clinic)

CASE 1—Woman 54, who had been treated with cortisone for rheumatoid arthritis, noted epigastric distress for three weeks. Because of this, dosage had been decreased from 100 to 75 mg./day The face was full, hemoglobin content was 7 Gm./100 cc., and x rays of the stomach revealed a penetrating ulcer on the lesser curvature proximal to the pylorus. She had severe pain and vomited dark brown material eight days after hospitalization. She was given 2,000 cc. blood, and cortisone dosage was reduced to 50 then to 37.5 mg./day by mouth. About three weeks later, an additional 100 mg cortisone was given intramuscularly, and the next day a subtotal gastrectomy was performed She remained semiconscious after the operation signs of shock and anuria appeared. Despite intramuscular administration of 300 mg cortisone, she died 30 hours postoperatively At autopsy the adrenals were atrophic, the right weighed 2.7 Gm., and the left 3 Gm. The pituitary body was smaller than normal and sections disclosed loss of granularity in basophils, with hyalinization and vacuolization

CASE 2.—Woman, 54, hospitalized with rheumatoid arthritis of eight years duration, had been treated with cortisone for one year While she was receiving substantial amounts of cortisone, cystocele and rectocele had been repaired without untoward reaction. Cortisone was discontinued on hospitalization. There was little reaction to withdrawal after the first two weeks In the next four months a total of 422 mg hydrocortisone was injected into joints on six occasions. About five months after admission a bilateral bunionectomy was performed. Irreversible shock appeared 15 hours later and despite 125 mg cortisone and 100 mg hydrocortisone, the latter given intravenously she died 16 hours after operation The right adrenal gland weighed 3.8 Gm., the left 3 7 Gm. the cortex was 1 mm. thick, and there were loss of vacuolization and increase in granularity of the cells of the zona fasciculata. The pituitary was small with decrease in number of basophils.

---

(5) J.A.M.A. 152 1509 1515 Aug. 15 1953

The average weight of adrenal glands in 46 patients treated with cortisone was significantly less than that in 42 who died of similar conditions but had never received cortisone Conspicuous adrenal atrophy occurred in only a small proportion of patients The most consistent reduction occurred in patients who were treated for five or more days and until the day before death. In adrenals examined after treatment had been discontinued for several weeks or months, evidences of recovery were seen, with more lipid in the cells of the zona glomerulosa and the outer portions of the zona fasciculata

Since corticotropin appears to be as effective as cortisone in producing histologic changes in the pituitary gland, it would seem safest to assume that the endogenous secretion of corticotropin is depressed by exogenous corticotropin and that postoperative adrenal insufficiency is just as likely to follow corticotropin therapy as cortisone therapy

It is advisable to consider the hazard of potential adrenal cortical insufficiency in any patient who requires surgery and who has had previous treatment with these hormones Intramuscular injection of cortisone should be given preoperatively if the hazard is considered serious. All patients should be observed carefully to avoid postoperative insufficiency if possible and to treat it promptly if it is encountered.

Bilateral Adrenalectomy in Treatment of Advanced Neoplastic Disease. Wiley F Barker, Eric T Yuhl, John M. Beal, Jr Malcolm R Hill, Jr and Willard E Goodwin[6] (Univ of California, Los Angeles) performed bilateral adrenalectomy in combination with castration on nine patients. All had received combinations of surgery and irradiation or hormone therapy, and the disease had reached a stage that precluded amelioration by further standard technics. The conditions treated included melanoma, carcinoma of the breast and carcinoma of the prostate

CASE 1 —Man, 29 was hospitalized for pain in the back and abdomen A melanoma had been removed from the base of the left second toe three years previously Three months later femoral node dissection was performed because of metastases. Examination re-

(6) West J Surg 61 491 498 September 1953

vealed a large mass filling the right side of the abdomen. Bilateral adrenalectomy, orchiectomy and biopsy of the melanotic mass relieved the pain for a short time. Cortisone dosage was maintained at 50 mg/day. No appreciable change in the mass was noted, and he worsened progressively and died.

CASE 4.—Woman, 42, had radical mastectomy for carcinoma of the breast which extended to axillary nodes. Pulmonary metastases were noted three months later, and irradiation of 900 r was given to each ovary. Testosterone was prescribed. An accumulation of bloody pleural fluid was noted. Back pain did not respond to x-ray therapy to the lungs. Bilateral adrenalectomy and oophorectomy were performed 16 months after the original operation. Six months later there was no pain, progression of pulmonary metastases or pleural fluid. She was maintained on 37 mg cortisone daily.

CASE 9.—Man, 65, was treated four years previously for carcinoma of the prostate by transurethral resection and bilateral orchiectomy followed by estrogen therapy. There had been no significant relief of pain in the back and perineum. He was hospitalized with a large tumor which extended completely around the rectum. Following right adrenalectomy he was given 100 mg hydrocortisone daily to produce atrophy of the remaining adrenal. The left adrenal, removed 40 days later, showed slight atrophy of the zona reticularis. He was maintained on 50 mg cortisone daily and estrogenic substances. There was no relief of pain or change in acid phosphatase levels. Palliative x-ray therapy was initiated after increase of perineal pain. X-rays showed an increase in extent of bony metastases.

Adrenalectomy and removal of the gonads offers some relief of pain in neoplasms of the breast and prostate that are subject to hormonal influences. The procedure is designed solely as an aggressive form of palliation and should be presented as such to the patient and his family.

[The contribution of bilateral adrenalectomy made by Huggins and Scott in 1945 seems to be worth while as a palliative procedure in properly selected cases of advanced cancer of the prostate and breast.—Ed.]

Clinical and Metabolic Studies of Bilateral Adrenalectomy for Advanced Cancer in Man. Olof H. Pearson, Willet F. Whitmore, Jr., Charles D. West, Joseph H. Farrow and Henry T. Randall[7] (New York City) report their experience with bilateral adrenalectomy in 12 patients with advanced prostatic cancer, 12 with advanced breast cancer and 9 with various other inoperable tumors. All those with breast cancer and 10 with prostatic cancer had been previously castrated. Bilateral adrenalectomy was always performed in

(7) Surgery 34:543-556, September 1953.

one stage, usually through bilateral lumbar incisions. The only hormone replacement therapy during and after operation consisted of cortisone or hydrocortisone orally

In only one patient with prostatic cancer was there objective regression of tumor masses after adrenalectomy Although five had symptomatic improvement for two to seven months, radiographs showed progressive growth of tumor metastases, and four subsequently died of cancer Six patients failed to improve Adrenalectomy for advanced prostatic cancer as now carried out is, consequently, not a practical therapeutic procedure

Cortisone and hydrocortisone are metabolized in man into at least one end product with androgenic properties—11 OH androsterone The use of corticosterone for the maintenance of patients who have undergone bilateral adrenalectomy is under study, since it does not appear to be metabolized into the usual neutral 17 ketosteroids

In one patient with advanced mammary carcinoma, major therapeutic improvement was still evident nine months after adrenalectomy Of four others with short clinical remissions, two had relapsed after four months. Seven patients failed to improve. Present trends suggest that patients with a favorable response to castration are more likely also to have a favorable response to adrenalectomy Results of this study indicate that adrenalectomy decidedly inhibits the growth of mammary carcinoma in some patients for a time but has no such effect whatever in others

No significant alteration in growth of the nine miscellaneous tumors could be detected after bilateral adrenalectomy

Hormonal replacement is adequate after adrenalectomy with cortisone therapy alone The average dose is 50 mg / day administered orally in divided doses of 25 mg every 12 hours. The dosage is adjusted to the individual patient on the basis of his sense of well being, strength and appetite There is no single laboratory test which helps to define the eucorticoid state Withdrawal of cortisone, because it promptly produced symptoms of low adrenocortical activity was not feasible Studies of water and electrolyte metabolism during cortisone withdrawal were surprising in

additional means of temporary control of advanced breast cancer, particularly in patients who have responded to castration.

As of Dec. 1, 1953, 30 patients with breast carcinoma had been adrenalectomized Of these, 40% had shown objective evidence of response for an average of nine months. The longest survival period without relapse had been 14 months.

THE GENITOURINARY SYSTEM

Circumcision of Newborn Appraisal of Its Present Status. Harold Speert[9] (Columbia Univ) notes that despite much controversial historical discussion concerning the value of circumcision, the circumstantial evidence that the foreskin plays a role in the genesis of penile cancer is incontrovertible This fairly common form of cancer seldom occurs in men circumcised early in life

As carcinoma of the penis usually begins on the glans or in the coronal sulcus, it is obvious that circumcision does not remove tissues which are the main sites of penile cancer Smegma is considered the tangible agent responsible for carcinogenesis in the penis

In New York City an average of 18 7 deaths per year, in the years 1939-50, were due to carcinoma of the penis

The discomfort, time and cost of circumcision of the newborn are trivial in comparison with the anticipated benefits of the operation. Hemorrhage, infection and operative trauma are exceedingly rare The use of the Gomco clamp has reduced the opportunity for injury to the glans or for removal of too much foreskin In 10 802 newborn circumcisions at one New York hospital from 1933 to 1951, there were only 6 recorded mishaps

During 1939-51 there were 224 recorded deaths from carcinoma of the penis in New York City, but only one death and a few nonfatal accidents resulting from neonatal circumcision.

(9) Obst. & Gynec. 2 164 172, August, 1953.

Trypsin Therapy in Management of Chronic Surface Ulcers Alma Dea Morani[1] (Philadelphia) used trypsin in six cases of chronic surface ulcer resistant to conventional surgical management

Trypsin's greatest enzymatic activity is demonstrated at pH 7, and it is advisable therefore to irrigate the wound



Fig 98 (left) —Diabetic gangrene of sole of right foot of four months' duration. Fistula between two openings with spreading cellulitis and considerable necrotic drainage.

Fig. 99 (right) —Appearance two weeks later showing same foot after trypsin therapy Trypsin administered by irrigation through catheters in sinus tracts. Photos taken two months post treatment.

(Courtesy of Morani, A. D Plast. & Reconstruct. Surg. 11 372 379 May 1953)

with Sorenson's phosphate buffer solution before using the trypsin powder Trypsin has a broad spectrum of proteolytic activity but will not act on exposed fibrous tissue, bone and cartilage Living cells and serum contain a specific trypsin inhibitor and several nonspecific inhibitory substances which protect the living cells from proteolytic activity The disappearance of bacteria from trypsin treated lesions apparently results from a strengthening of the local humoral defense mechanisms once the bacteria have been deprived of their culture mediums, i.e., slough, debris and necrotic tissue Once the viscid coating is physiological

(1) Plast. & Reconstruct. Surg 11:372-379 May 19 3

ly debrided the enzyme attacks the necrotic layers that have covered the wound for weeks or months Soon the exudate becomes clear and the wound fresh looking with a pink healthy granulating surface where viable leukocytes appear (Figs 98 and 99)

Trypsin may be applied in the form of a dry powder after irrigation with the phosphate buffer by sprinkling or insufflation, in gelatin capsules for sinuses and fistulous tracts so plugged with necrotic debris that irrigation is im practical or impossible, in the form of wet dressings, or by irrigation or infiltration with a hypodermic needle beneath the eschar or into the necrotic tissue

To avoid unnecessary use of large amounts of enzyme, necrotic tissue can at times be debrided mechanically before and after trypsin application. Whenever possible the powder form should be used rather than the solution since the powder provides greater proteolytic action.

Studies of Combined Vascular and Neurologic Injuries II. Effect of Arterial Ligation and of Sympathetic Denervation on Return of Function After Crushing the Sciatic Nerve of the Rat In a previous study, Arnold Kunkler and Harris B Shumacker, Jr[2] (Indianapolis) *found that simultaneous* ligation of the common iliac and femoral arteries of an ex tremity was followed by a low incidence of tissue necrosis but a high incidence of ischemic paralysis Recovery from the paralysis was hastened by immediate sympathectomy When arterial ligation was combined with section of the sciatic nerve fibers, preserving the neural sheath, recovery of neural function was delayed and tissue necrosis was strikingly increased. Sympathectomy greatly reduced fre quency of tissue necrosis

Technic.—Five groups of rats were used. The neurologic injury was inflicted by crushing the left sciatic nerve for 10 seconds. Ar terial injury consisted of division of the left common iliac and femoral arteries. Sympathectomy was performed transperitoneally Sympathetic chains were resected from the level of the renal vessels to the bifurcation of the aorta Only the sciatic nerve was crushed in the 1st group the arteries were divided and the nerve crushed in the 2d in the 3d group iliac artery division and sympathectomy were done, followed by femoral artery division and nerve crush the

(2) Surgery 34 607-613 September 1953

next day, sympathectomy and nerve crush were done in the 4th group, nerve crush was followed in 10 days by lumbar sympathectomy in the last group

Arterial division prolonged the interval before return of nerve function and sympathectomy shortened the period appreciably The period of regeneration was the same whether sympathectomy was performed at the time of crushing the sciatic nerve or 10 days later There was a trend toward a decreased incidence of tissue necrosis when sympathectomy was performed.

There is no statistical significance to the slight increase in percentage of necrosis in animals with arteries divided and nerves crushed as compared with the controls Rate of regeneration of the crushed sciatic nerve, measured by return of full neurologic function, depends on the blood supply to the limb

Treatment of patients by sympathectomy has been considered useless because there is sympathetic paralysis in the area of anesthesia and because a warm phase, characterized by vasodilatation in the anesthetized portion of the limb, occurs shortly after complete division of a peripheral nerve This sympathetic paralysis in the anesthetic skin does not necessarily indicate that blood flow is maximal in other portions of the limb or that the injured nerve itself is receiving adequate circulation

Some Unsolved Problems in Surgery of Sympathetic Nervous System are discussed by James Paterson Ross[3] (St. Bartholomew's Hosp., London) One of these is the variability in response to sympathectomy This is matched by a similar divergence of expert opinion on the subject, which is more apparent than real. One observer may be reporting on recovery of function in a denervated organ and another on recovery of conductivity in the sympathetic nerves themselves Differentiation between these forms of recovery is of practical importance Tests indicating persistence or restoration of sympathetic innervation disclose an anatomic error in technic which may be remediable, whereas those showing persistent disorder of function in a diseased organ despite sympathetic denervation indicate an error of judg

(3) Quart. Bull. Northwestern Univ M. School 8 1 9 1954

ment in selection of the patient for operation. The immediate postoperative increase in blood flow to a sympathectomized limb decreases in a few days as a result of an unexplained *change in the arterial walls* This takes place even when tests indicate that sympathectomy is complete and, therefore, must be regarded as a natural consequence of the operation and not an indication of failure Also unexplained is the fact that the extremities remain warm independently of the diminished blood flow Denervated structures become more sensitive to the chemical substances which normally mediate nerve impulses to them This mechanism may explain, at least in part, the poor results of sympathectomy often seen in Raynaud's disease

Although sympathectomy has been used in most forms of vascular disease at some time, it is a fallacy to consider arterial spasm an important cause of ischemia Spasm has been thought to be a factor in Raynaud's disease causalgia, intermittent claudication and the phenomena involving the limb that becomes pale and pulseless with exercise A more serious error is to regard the natural increase in blood flow after vasomotor block as evidence of arterial spasm

There is ample evidence of the sympathetic innervation of collateral vessels Although the initial increase in blood flow through them after sympathectomy diminishes considerably, the final result is usually sufficient to justify the operation especially when it is a complete block of the main vessel. Little benefit from sympathectomy is likely if there is widespread arterial degeneration or wasting of the painful muscles An important question, as yet unsettled, is the amount of lateral sympathetic trunk which should be removed for ischemia of the leg For complete sympathectomy of the whole lower extremity resection should include the first lumbar ganglion This operation must be performed for an iliac arterial block when dilatation of the collateral vessels in the hip region is desired However, evidence suggests that this high operation can rob the distal tissues of blood by opening the proximal vascular bed Pain in the foot at rest is a premonitory symptom of gangrene Immediate sympathectomy for incipient gangrene of the toes is hazardous, especially in the presence of edema

After sympathectomy the minute vessels at first dilate and soon tone begins to return This increase in tone is due to reduction in the concentration of vasodilator substances as a result of the increase in blood flow and also to increased sensitivity of the denervated vessels to circulating vasoconstrictor substances The late result of sympathectomy is characterized by the paler skin of the denervated area Benefit of sympathectomy in Raynaud's disease is limited by the inevitable return of tone to the arterial coats, but the digital arteries will no longer be subject to sudden changes in caliber and minute vessel circulation will be more stable Acrocyanosis with involvement of the arterioles, is more satisfactorily treated by sympathectomy The late effect of sympathectomy on the minute vessels of the skin is beneficial in treatment of erythralgia, which is characterized by local redness, tenderness, swelling and burning pain and is relieved by measures constricting the minute vessels The pain of causalgia may be benefited by sympathectomy Some consider this due to the increase in tone of overdistended vessels and others to the increased blood flow to the skin which washes away substances formed at the nerve endings that are responsible for pain and vasodilatation.

Sympathectomy of Upper Extremity Evaluation of Surgical Methods Bronson S Ray[4] (Cornell Univ) believes that the sympathetic supply to the upper extremity is so great that no practical operation, whether pre or postganglionic, or both, can reliably effect absolutely complete denervation. Theoretically this could be assured only by section of motor roots important to muscular function of the limb However, current pre or postganglionic operations often produce good clinical results despite their imperfections

The first thoracic complex of root nerve and ganglion plays a part in sympathetic innervation of the extremity and should not be preserved just to prevent Horner's syndrome, which is not offensive to most patients There is little, if any, significant difference in arteriolar sensitivity to circulating epinephrine after pre and postganglionic opera

(4) J Neurosurg 10 624-633 November 1953

tions in man, and one need not insist on the former The possibility of regeneration after preganglionic sympathectomy can be obviated by paravertebral ganglionectomy extensive enough to remove the cells of the postganglionic neurons. Resection of the cervicothoracic ganglionated chain will not significantly increase arteriolar sensitivity in the upper limb, but will prevent regeneration through removal of cells of the postganglionic neurons and will provide as complete sympathetic denervation of the upper limb as can be achieved, short of paralysis

Since postganglionic cells may exist in ganglions of the cervical trunk above the stellate ganglion, the excision should include the middle cervical ganglion in those patients who have one Excision downward should include at least the third thoracic ganglion. Such resection is best performed through an anterior supraclavicular incision Less extensive resection to spare ganglions above the stellate ganglion is possible by a posterior approach but it is more mutilating, results in a more stormy convalescence and may lead to intercostal dysesthesia. Postganglionic resection of the cervicothoracic chain from the midcervical to the third thoracic ganglion is as good an operation as any preganglionic one yet devised, and probably better

Further Investigations on Use of Heparin in Treatment of Experimental Frostbite Robert B Lewis and Paul W Moen[5] (U.S.A.F School of Aviation Medicine) compared the extent of muscle and skin necrosis in 87 of 311 heparinized rabbits after exposure of a hind leg to cold alcohol at either —12 or —15 C for 30 minutes in 13 separate experiments with that in 118 not heparinized but similarly exposed The incidence and extent of gangrene were no lower in heparinized animals, even though blood coagulation times were kept at or above 30 minutes during the treatment period. The death rate of heparin treated animals was significantly higher than that among the controls

The study showed that heparin therapy had no effect either on the incidence or on the extent of skin and muscle necrosis The use of heparin in cold injuries is based on the assumption that tissue death is secondary to vascular throm

(5) Surg Gynec & Obst 97 59-60 July 1953

bosis, but the observations do not agree with this hypothesis Thrombosis has been noted only after 24 hours and is seen only in areas already necrotic It is therefore concluded that the thrombosis in cold injuries, as in other destructive injuries, is a secondary and protective mechanism

Management of Frostbite in Korean War Francis W Pruitt[6] (M C, U.S.A.) states that the term frostbite or cold injury includes all types of tissue damage resulting from exposure to low thermal environment with or without moisture There were many cold injury cases in Korea during the first year of the war and a specialized center for their management was established in Japan. Diagnosis of cold injury was made in 84 3% of 2 257 patients admitted to the center Casualties were classified according to involvement first degree (hyperemia, erythema, tingling and burning) 16 7%, second degree (hyperemia with vesicles or blisters) 33 6%, third degree (necrosis through skin and into subcutaneous tissue) 43 6% and fourth degree (all tissue, including bone gangrene and loss of distal tissue) 6 1% The feet only were involved in 86%, hands and feet in 11%, hands only in 2 5% and ears face or knees in 0.5% Most of the injuries occurred when the troops were immobilized in cramped, cold and wet areas for long periods and could not change their socks

Subjectively the men had no pain at first but were aware of pronounced coldness and felt that their "feet had gone to sleep" Many rewarmed their feet by physical activity, holding the affected part near a fire, by massage and by rubbing with snow Marked burning aching and paresthesias followed rewarming In one to three hours there was swelling followed by blisters

Early treatment in the forward areas included rapid thawing at 86-89 F., carrying all patients on litters, no tobacco feet left uncovered, and daily application of zephiran* (1 1,000 solution) Blisters and bullae were not aspirated because they protect the underlying tissue Definitive hospital care consisted of bed rest until tissue healing was sufficient to allow the patient out of bed, no tobacco, maintenance of room temperature at 78 F or below,

(6) Nebraska M. J 39 2-8 January 1954

debridement only when there was suppuration and then merely to swab away necrotic material, 0.1% procaine intravenously to relieve pain, penicillin, nutritious diet and other supportive measures. Early amputation was rarely indicated unless there was pronounced trauma or maceration. Early use of heparin was beneficial. Heparin in intravenous doses of 100 mg in 250 cc of 5% glucose to which were added 12 cc alcohol and 250 mg procaine was given every six hours. Corticotropin and cortisone were ineffective. Many severe cases required skin grafting. Grafting could not be done for periods up to 120 days because of the poorly vascularized bed and the vasospastic state of the vessels.

Of those with first degree injury 81% returned to general duty, in those with second degree injury 41%, in those with third degree injury 6% and none with fourth degree injury. The most outstanding sequela was the so-called post frostbite syndrome consisting of hyperhidrosis, some dependent rubor and sensitivity of feet to temperature fluctuations.

[The question of the treatment of frostbite has been a controversial one for many years. The large experience of Colonel Pruitt should be very helpful to anyone confronted with this problem.—Ed.]

Frostbite Resulting in Amputations. Thomas J. Canty and Andrew G. Sharf[7] (U.S. Naval Hosp., Oakland, Calif.) report 15 cases of frostbite incurred by the Marine Corps during 1950 in Korea. The time of the original exposure to cold varied from three days to one week. In 11 patients the symptoms were confined to the feet, 4 had a combination of upper and lower extremity involvement, and none had symptoms confined to the upper extremity. Extremities with associated missile wounds were always frostbitten.

The patients were put at rest and the gangrenous tissues allowed to demarcate (Figs. 100 and 101). Each was allowed to recover as much tissue as possible, and no predetermined levels of amputation were established. After demarcation, amputation was carried out through the adjacent normal appearing tissues (Fig. 102). A breakdown of the suture line, particularly in the distal types of amputations, was not uncommon. Further debridement and revision of the amputa-

(7) Ann. Surg. 138:65, July, 1953.

tion was carried out *An average of five operations were required to achieve a satisfactory stump*

Arteriograms did not help in locating an optimal site of amputation, but they re-emphasized two important features of the vascular pattern (1) a significant filling defect of

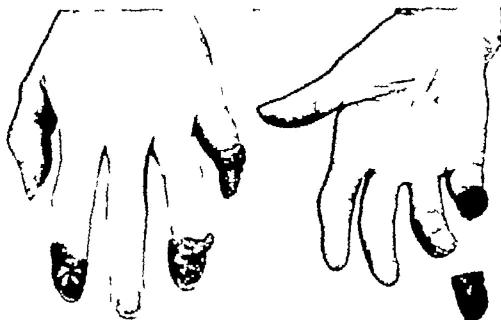




Fig 100 (above left) — Gangrenous involvement of hand due to frostbite.

Fig 101 (above). — Spontaneous separation of gangrenous portion of little finger New finger nail has developed.

Fig. 102 (left) — Final result after amputation. Recovery of hand with loss of only portion of little finger

(Courtesy of Canty T J., and Sharf, A. G.: Ann. Surg. 138 63-72, July 1953)

the distal arteriolar bed was always present in the unrevised frostbitten extremities and (2) a marked spasm of the proximal collateral vascular bed was present even four to five months after the initial injury by cold

Average period of hospitalization required per patient was 11½ months In 67%, a partial hand or foot was preserved. Patients initially treated with paravertebral blocks

required higher levels of amputation than the others not so treated.

Observations on Development of Circulation in Skin Grafts VI. Effect of Hyaluronic Acid and Homologous Skin Filtrate on Homologous Skin Grafts Herbert Conway, Richard B Stark, Doyle Joslin and Norman Buys[8] (New York Hosp Cornell Med. Center) made observations on homologous skin grafts in mice using a transparent tissue chamber and splint. Consistent thrombosis of blood vessels in the recipient bed of controls in which homografts had been transplanted led to the use of an anticoagulant (dicumarol●) New vessels grew toward the graft but none grew into it to nourish it permanently In an attempt to transfer the nonantigenic property of mucoprotein to homologous skin grafts, potassium hyaluronate was used in combination with dicumarol.● None of the grafts was successful.

Extract of mouse skin was given intraperitoneally, and homologous grafts were transplanted. None was successful. In mice treated with the homologous skin filtrate, autolysis of the graft was accelerated, suggesting a generalized vascular reaction to the filtrate It is believed the filtrate contained a factor responsible for the more rapid necrosis of homografts and for the variation in the vascular pattern in treated animals compared with homografts of skin in untreated animals.

Tourniquet Paralysis Syndrome, though rare, is easily overlooked because (1) the paralysis and associated phenomena can be relatively brief, (2) the lesion can be mild and result in incomplete paralysis, and (3) the sensory examination is usually confined to testing of pain sensation with a pinprick and, because of supposedly normal sensory findings, incomplete or even complete paralysis is often erroneously diagnosed as hysterical In tourniquet paralysis there is a disturbance in functions of the peripheral nerves apparently due to mechanical pressure of the tourniquet on the nerve not the result of ischemia. Joseph Moldaver[9] (Columbia Univ) reports seven cases of complete paralysis resulting from use of a tourniquet, three induced by rub

(8) Plast & Reconstruct. Surg 12 77 78 July 1953
(9) A.M.A. Arch. Surg. 68 136 144 February 1954

ber tube, two the result of Esmarch bandages and two due to an inflated cuff

Damage to the nerves is confined to a small, narrow and sharply localized area where maximal pressure is applied There is motor paralysis with hypotonia or atonia, but no appreciable atrophy Sensory examination shows dissociation of sensations Fibers subserving touch, pressure, vibration and position are affected, those sensations are usually absent Pain sensation is never lost. In most cases there is actual hyperalgesia, i.e., pain is felt with a low threshold In severe cases the first or fast pain can be affected Heat and cold sensations are seldom disturbed There is no paresthesia or tingling after release of the tourniquet, which is indicative of block of the touch fibers There is no Tinel sign and no neuroma at the site of injury Sympathetic fibers are not affected, and pilomotor reflex, skin resistance, limb color plethysmographic findings and skin temperature are normal. Electric studies show block of conduction characterized by lack of response to stimulation of the motor nerve above and good response below the injury There is no tingling sensation to stimulation of the sensory fibers distal to the site of injury, but there is a tingling sensation when the nerve is stimulated proximal to the lesion. Electric stimulation can localize the level of the lesion Duration of impairment of motor function and sensation may last three months or longer

Interdigital Sinuses of Barbers' Hands A R Currie, T Gibson and A. L Goodall[1] (Glasgow Royal Infirm) examined the hands of 77 barbers and found interdigital sinuses in some stage of development in 10 no such lesions were found in the hands of 61 women's hairdressers

Short sharp hairs clipped from the heads of the male customers tend to collect in the webs of the fingers of the barber during the day's work and may penetrate the epidermis As a result of secondary infection in the superficial corium small pits are formed and subsequently, small sinuses With the entry of more hairs through the sinus into the deeper layers of the corium and after further infective episodes, a longer sinus results An abscess may form

(1) Brit. J Surg 41 278-286 November 1953

and point in the palm or dorsum, and it may rupture or be incised to produce a tunnel or fistula

The lining of all sinuses consists of nonpigmented squamous epithelium with no rete pegs Sweat ducts are present in the epithelium lining the tunnel Cellular reactions to the hair shafts are variable In some cases numerous polymorphonuclears are present around the hair shafts, whereas in others lymphocytes and plasma cells predominate

A similar condition is encountered in the chronic scarring pseudofolliculitis of the Negro beard, which is caused by shaved hairs curling back and penetrating the epidermis It is suggested that postanal sinuses may have a similar origin.

If barbers paid sufficient attention to hand hygiene and removed the hairs, this lesion could be prevented Surgery is not advised in the early shallow pitted stage as the lesion will not progress if the hairs are removed each night Once the lesion has advanced beyond this stage, surgical excision is the treatment of choice Such a procedure, followed by a free skin graft or direct suture, has given satisfactory results

Recurring Myxomatous Cutaneous Cyst is reported by Norman H. Isaacson and Dennis McCarty[2] (George Washington Univ)

Woman, 44, had a blister like lesion (Fig 103) on the dorsoulnar side of the right middle finger at the distal interphalangeal joint which she "pricked' open several times, discharging a small amount of sirupy clear fluid. Each time it recurred within one to two weeks. Following surgical drainage it recurred in four weeks. Following complete excision six months after onset it recurred in six weeks. There was no inflammation and no bony involvement. A total of 1,000 r was administered to the lesion in three treatments at monthly intervals one year after onset. Four weeks after the last treatment, the cyst began to shrink and in six months had disappeared.

The patients are usually women (75%) in their forties The lesion occurs on the dorsal surface of the fingers in close proximity to the distal interphalangeal joint and is usually about the size of a pea The skin is of normal appearance Tenderness is mild or absent

Histologically there is localized degeneration in the cori

(2) Surgery 35 621 6 2 April 1954

ium with myxomatous change and liquefaction. There is no epithelial or endothelial lining Etiology is obscure

All treatment results in repeated recurrence except radiation therapy, which produces a cosmetically perfect result



Fig 103 —Myxomatous cutaneous cyst, showing characteristic location and appearance (Courtesy of Isaacson, N H., and McCarty D Surgery 35 621-623 April 1954)

Jacox and Freedman recommend a dose of 1,400-1,600 r (100 kv constant potential, 4 ma, 30 cm. focus skin distance, no added filtration, intensity 120 r/minute, portal size determined by lesion)

Present Status of Parabiosis as Related to Skin Transplantation. Kathryn Lyle Stephenson[3] (Santa Barbara, Calif.), in a review of the literature on parabiosis and homografting, found few original contributions or new technics to study Fundamental, biochemical, individual differences characterize each individual higher organism to be considered in every case of homotransplant After both free and flap homotransplants of skin in animals or in man, capillaries grow from the host into the homograft, ultimately, due to endothelial swelling, thrombosis and contracture of the surrounding connective tissue, the circulatory continuity fails and the graft sloughs How long actual capillary contact is maintained in two persons varies probably with the degree of phylogenetic and genetic relationship

Many studies have centered around the systemic effect of homografts in animals Changes, found in many organs, have been especially pronounced in the reticuloendothelial system Blockage of the reticuloendothelial system has been attempted by irradiation, splenectomy and the administra

(3) Plast. & Reconstruct. Surg 12 325-347 November 1953

tion of cortisone, trypan blue, corticotropin and antihistamines but without significantly prolonging the life of the homografts

Experiments with successive transplants of homografts have shown that vascular continuity is not established and that the disintegration of the tissue is mediated by body fluids, and not by cellular elements.

The review suggests an initial organismal differential probably with a genetic factor precluding permanent transplantation of blood nourished tissues from one animal to another of the same species for any length of time except in closely inbred animals of lesser genetic dedifferentiation In the most highly differentiated animal, man, the only homotransplants that have reportedly taken successfully have been transplants to identical twins

Effects of Skin Homografts on Growth Factors of Surrounding Host Epithelium. Leonard R Rubin Alfonso A. Diecidue and Richard D Murray[4] (Kings County Hosp, Brooklyn) excised 1 sq in of skin from opposite sides of the body in 15 volunteers One wound in each was covered with a homograft, and the other was left denuded for control study Both wounds were then dressed identically All but one homograft took the wounds initially appeared to be completely healed, but when the grafts finally disappeared, open areas remained In 14 patients, the grafted areas healed completely, either simultaneously or shortly after the control areas in the 15th, the grafted area healed a day sooner than the control area. Complete healing took 30-35 days

The study indicates that human homografts on wounds do not stimulate faster growth of and coverage by surrounding host epithelium.

Glomus Tumor Report of Two Cases is presented by L W Kaplan and Samuel Karlin[5] (Louisiana State Univ) The normal glomus, a specialized arteriovenous anastomosis without an intermediate capillary bed, is usually located in the stratum reticulare of the cutis and helps to regulate local and body temperatures the glomic tumor represents

(4) Ann. Surg. 138 867 869 December 1953
(5) Am. J Surg 86 192 195 August 1953

benign hypertrophy of the glomus, with enormous development of the vessels, and an abundance of epithelioid cells and nerve fibrils Common sites of these tumors are the ventral surface of the hand and the foot, ventral and lateral parts of the digits, the nail bed, the nail matrix, the thenar and hypothenar eminences of the hand and the sole of the foot near the heel Pain is precipitated by pressure or temperature change Grossly, the glomic tumor is a small, well defined, pinkish to bluish area, 1 12 mm long The treatment of choice is surgical excision The following case is typical.

Woman, 52, for two years had had tenderness and almost constant throbbing pain, intensified by jarring and exposure to cold, in the left ring finger For one year, she had had a bluish area, 1 mm. in diameter, in the nail bed of that finger Removal of the nail after local nerve block disclosed a small, bluish tumor, which was then excised along with a margin of normal tissue around it. Benign glomus tumor was diagnosed. She has been symptom free for three years, without recurrence.

tion of cortisone, trypan blue, corticotropin and antihistamines but without significantly prolonging the life of the homografts.

Experiments with successive transplants of homografts have shown that vascular continuity is not established and that the disintegration of the tissue is mediated by body fluids, and not by cellular elements

The review suggests an initial organismal differential probably with a genetic factor precluding permanent transplantation of blood nourished tissues from one animal to another of the same species for any length of time except in closely inbred animals of lesser genetic dedifferentiation. In the most highly differentiated animal, man, the only homotransplants that have reportedly taken successfully have been transplants to identical twins

Effects of Skin Homografts on Growth Factors of Surrounding Host Epithelium Leonard R. Rubin, Alfonso A. Diecidue, and Richard D Murray[4] (Kings County Hosp., Brooklyn) excised 1 sq in. of skin from opposite sides of the body in 15 volunteers One wound in each was covered with a homograft, and the other was left denuded for control study Both wounds were then dressed identically All but one homograft took, the wounds initially appeared to be completely healed, but when the grafts finally disappeared, open areas remained. In 14 patients, the grafted areas healed completely, either simultaneously or shortly after the control areas, in the 15th, the grafted area healed a day sooner than the control area. Complete healing took 30-35 days.

The study indicates that human homografts on wounds do not stimulate faster growth of and coverage by surrounding host epithelium.

Glomus Tumor Report of Two Cases is presented by I. W Kaplan and Samuel Karlin[5] (Louisiana State Univ) The normal glomus, a specialized arteriovenous anastomosis without an intermediate capillary bed, is usually located in the stratum reticulare of the cutis and helps to regulate local and body temperatures, the glomic tumor represents

---

(4) Ann. Surg 138 867-869 December 1953
(5) Am. J Surg 86 19 195 August, 1953

benign hypertrophy of the glomus, with enormous development of the vessels, and an abundance of epithelioid cells and nerve fibrils Common sites of these tumors are the ventral surface of the hand and the foot, ventral and lateral parts of the digits the nail bed, the nail matrix, the thenar and hypothenar eminences of the hand and the sole of the foot near the heel. Pain is precipitated by pressure or temperature change Grossly, the glomic tumor is a small, well defined, pinkish to-bluish area, 1 12 mm long The treatment of choice is surgical excision The following case is typical.

Woman, 52, for two years had had tenderness and almost constant throbbing pain, intensified by jarring and exposure to cold, in the left ring finger For one year, she had had a bluish area, 1 mm. in diameter, in the nail bed of that finger Removal of the nail after local nerve block disclosed a small bluish tumor, which was then excised along with a margin of normal tissue around it. Benign glomus tumor was diagnosed. She has been symptom free for three years, without recurrence

ANESTHESIA

Edited by

STUART C CULLEN M D

NARCOTICS AND ANTAGONISTS

Effect of Levallorphan Tartrate on Opiate-Induced Respiratory Depression was studied by William K. Hamilton and Stuart C Cullen[1] (State Univ of Iowa) In the investigation, 19 patients scheduled to undergo surgical procedures that required minimal relaxation were used One group (14 patients) was anesthetized with nitrous oxide-oxygen in nonhypoxic concentration supplemented by intravenous overdoses of one of three opiates—levo-dromoran® tartrate, demerol® and morphine Anesthesia having been established and *the operative procedure begun, the* antagonist (levallorphan tartrate) was administered intravenously The effects on respiration were noted and an attempt was made to determine clinically any effect on the level of anesthesia In the other group of five patients the antagonist was given first, followed by the analgesic drug Nitrous oxide-oxygen was then administered and effects on respiration noted and operations performed

In all patients and with all three analgesic drugs, the antagonist was effective After an initial peak response, there was some decrease in effect, but never any serious respiratory depression. Once respiration had returned to initial levels, additional levallorphan tartrate had no effect on it

It appeared quite definitely that the combination of any one of these narcotics and levallorphan tartrate did provide a supplement to nitrous oxide anesthesia without the disadvantage of respiratory depression. *In no patient was the* abolition of respiratory depression accompanied by decrease

---

(1) Anesthesiology 14 550-554 November 1953

in depth of narcosis This suggests that although respiratory depression is abolished, some action of the opiate drugs used persists

Effects of n Allylnormorphine on Respiratory Depression Due to Morphine in Anesthetized Man with Studies on Response to Carbon Dioxide Charles M. Landmesser, Sanford Cobb and J Gerard Converse[2] (Albany Med. College) studied nine patients who had received relatively large doses of morphine prior to and/or during thyroidectomy under endotracheal nitrous oxide oxygen anesthesia. Immediately after the operation, and with the patient still anesthetized, a calibrated bellows breathing bag modified to function as a simple quantitative spirometer was substituted for the regular breathing bag of the anesthesia machine A tracing was obtained of each patient's respirations (1) during a control period of breathing 100% oxygen, (2) during a period of rebreathing carbon dioxide for approximately five minutes while the carbon dioxide absorption canister was by passed, (3) during a recovery period of approximately five minutes, (4) during the administration of n allylnormorphine (5 mg) intravenously and the response period of approximately five minutes which followed and (5) during a second period of rebreathing carbon dioxide From this tracing, respiratory rate and minute volume at the end of each test period were measured directly and the tidal volume calculated. At the end of each of the five test periods, arterial blood specimens were collected for determination of oxygen and carbon dioxide content

The authors conclude that when given before morphine the allyl compound not only does not stimulate respiration but, indeed causes a depression which is probably due to a decrease in the sensitivity of the respiratory center to carbon dioxide as is usually effected by morphine derivatives and other respiratory depressants However when the allyl derivative is given after morphine the respiration is stimulated beyond the normal level, not by the drug itself but by the excessive concentration of carbon dioxide which has accumulated during the morphine depression and which

(2) Anesthesiology 14 535 549 November 1953

has a greater stimulating effect on respiration once the sensitivity of the respiratory center returns toward normal from its pre existing state of morphine depression. This return toward normal is effected by n allylnormorphine, which probably displaces morphine from certain receptors in a competitive fashion Although slightly depressant to the respiratory center itself, it is less depressant than morphine Displacement of morphine increases the sensitivity of the respiratory center to carbon dioxide with resultant increase in respiratory rate and exaggerated tidal volume This lasts only a few minutes—until the carbon dioxide concentration in the blood is reduced to a more physiologic level, then respirations become normal

Three sets of observations support this explanation based on the phenomenon of drug competition. (1) Chemical the close relationship between the chemical structure of n allylnormorphine and its specificity of action is strongly suggested by the fact that it apparently antagonizes the depression produced only by morphine and other narcotics structurally related to morphine (2) Pharmacologic the allyl derivative shares with morphine many of its narcotic properties in a milder or slightly varied degree, and its cholinesterase inhibiting property in a slightly greater degree (3) Physiologic (a) when injected into mice after morphine, n allylnormorphine rapidly abolishes the analgesic effect of morphine and reduces the threshold for pain perception to the level obtained by n allylnormorphine alone, (b) when injected into cats after morphine, n allylnormorphine abolishes the restlessness, marked irritability, in-co-ordination and extreme mydriasis produced by morphine, and (c) n allylnormorphine produces acute "abstinence syndromes" within 15 minutes when given subcutaneously to morphine addicts

Cardiac Output by Cuvet Oximeter under Thiopental. The dye dilution method of determining cardiac output is thought to be more apt to reflect physiologic variations than the Fick method Use of the cuvet oximeter is desirable for experimental work since several experiments may be carried out on one animal within a short time and rapid fluctuations noted. Esther M. Greisheimer, Dorothy W Ellis, Howard N Baier, Gordon C Ring Lydia Makarenko and Joan Graziano[3] (Temple Univ) determined the mean thiopental concentration, cardiac output, heart rate, systolic,

RESULTS OF SUCCESSIVE DETERMINATIONS OF CARDIAC OUTPUT

Dye Curve	No. of Animals	Thiopental Conc. in Blood, mg/l	Cardiac Index, l/min/m of B A	Heart Rate	Systolic Pressure	Diastolic Pressure	Mean Blood Pressure	Peripheral Resistance	Duration of Anesthesia, min	Total Dose of Thiopental, cc/kg	Total Dose, mg/kg
	21	14.80	2.985	75	19	18	142	39 7	28 6	60	20 0
	23	5.8	3.66	82	190	16	42	20 8	33 6	67	1.4
3	23	17 29	4 368	180	[illegible]	16	45	104 8	38.8	1 9	23 8
4	16	7 98	5.016	180	197	114	14	91 6	42.0	1 27	25.4
5	3	7 21	5 260	77	[illegible]	116	146	89 3	44.0	1 3	26
6	8	8 11	5 690	77	[illegible]	1 3	50	87 6	47 0	1.44	28 8

diastolic and pulse pressures, peripheral resistance, duration of anesthesia (or analgesia) and total amount of thiopental in mg /kg body weight administered, for each dye curve The results are presented in the table A total of 106 measurements of cardiac output in 26 dogs was made

Although the cardiac output was not dependent on the arterial blood level of thiopental, the duration of anesthesia (or analgesia) seemed an important factor As the duration increased, the cardiac output increased Perhaps this increase in cardiac output is due to progressive splanchnic vasodilatation the spleen is congested under barbiturates. The total dose of thiopental injected has no direct bearing on the blood level, as is to be expected since it is deposited in the fatty tissues

Pediatric Preanesthetic Preparation problems are preventive in nature avoidance of psychic trauma, prevention

(3) Am. J Physiol 175 171 172 November 1953

of mucous secretions during general anesthesia, prevention of reflex hyperactivity and prevention of respiratory depression from oversedation Charles L Burstein[4] describes the technic used at The Hospital for Special Surgery, New York City, to overcome these problems

To minimize psychic trauma "preanesthetic hypnosis" is produced by means of thiopental given rectally This consists in the administration of a dose of thiopental sodium rectally while the child is still in his room, about 45 minutes before being taken to the operating room. The dose is a 10% solution containing 1 Gm for 75 lb body weight, with 1 Gm. being the maximal dose even if the child weighs over 75 lb This dose usually produces drowsiness in about 30 minutes, but the child can be easily aroused and no respiratory depression has been observed

The author urges early admission to the hospital for elective surgical procedures, preferably two days before surgery Pleasant and reassuring personnel on the pediatric service are of utmost importance

To prevent or minimize the reflex hyperactivity peculiar to children, procaine amide was used The dose was 20 mg per year of the child's age up to age 10

Because atropine too often has been deficient as a drying agent despite the production of undesirable side effects such as tachycardia hyperthermia and skin erythema, Burstein studied the effects of methantheline bromide (banthine•) This drug has been shown to act as a ganglion blocking agent on both the sympathetic and the parasympathetic nervous system, and it also exerts an additive atropine like action at the postganglionic nerve endings of the parasympathetic system Since the dosage of this drug in children had not been evaluated previously, a satisfactory dosage scale was found by prescribing 1 mg/year of the child's age between 1 and 10 years In this study it was convenient to dissolve the contents of a 50 mg ampule of banthine• with 10 ml. of a 10% solution of procaine amide hydrochloride which comes in a rubber stoppered vial. This solution remains stable for two weeks Each cubic centimeter of this mixture contains the dose for a 5 year old

(4) Anesthesiology 14 567 571 November 1953

child The proper dose is administered intramuscularly about 30 minutes before induction of general anesthesia.

The effect of banthine® on mucous secretions was excessive in 95% of the cases. There was no remarkable difference in the average pulse rates during general anesthesia in the children premedicated with either atropine or banthine.® There was no appreciable skin flushing in 90% of the cases in which banthine® was used, and there was no postoperative hyperthermia. The pediatric nursing staff noted a pronounced decrease in the incidence and severity of postoperative vomiting in the children who had been premedicated with banthine® in comparison with those who had been given atropine

Because of all these findings the author considers banthine® to be a better drug than atropine for preanesthetic medication in children.

[Unfortunately this article does not include the data on the study of atropine and banthine.® Others who have used banthine® find no significant differences between it and atropine in respect to its use as a premedicament drug.—Ed.]

Evaluation of Pentylenetetrazol as Barbiturate Antagonist. Albino mice were given, intraperitoneally and simultaneously, LD[illegible] and higher doses of pentobarbital sodium and 200-1 000 mg/kg pentylenetetrazol (metrazol®) The animals were observed from the time of injection until recovery or death. Joseph F Fazekas and Theodore Koppanyi[5] (Georgetown Univ) found that LD[illegible] pentobarbital sodium given alone caused death rapidly, usually within 15 minutes. Therefore physiologic antidotes must be injected immediately if they are to exert significant protective action.

All animals receiving 150 mg pentobarbital sodium (LD[illegible]) and 200 mg pentylenetetrazol simultaneously survived. When the dose of the latter was increased threefold, some mice died because of pentylenetetrazol overexcitation —none from depression

Mice given doses of pentobarbital sodium higher than LD[illegible] were only occasionally saved by pentylenetetrazol even though the dose was increased up to 1,000 mg/kg These experiments confirm conclusions drawn by other

(5) Anesth & Analg 33 58-63 Jan.-Feb., 1954

workers as to the limits of the antagonism between barbiturates and analeptics

Pentylenetetrazol has a definite place in the treatment of barbiturate poisoning, it should be given as early as possible, with the dosage adjusted to meet the individual needs of the patient—until purposeful movement or consciousness returns It should supplement, not replace, good nursing care and maintenance of adequate respiration.

[One need not expect that the success reported by the authors in albino mice establishes the effectiveness of pentylenetetrazol as an antagonist to barbiturate poisoning in human beings.—Ed.]

Effect of Sodium Succinate and Some of Its Derivatives on Thiopental Anesthesia was studied by N J Giarman, R. P Rowe and J F Young[6] (Yale Univ) Sodium succinate, ethyl succinate and bis-dimethylaminoethyl succinate were administered to adult, male albino mice by one of two methods (1) intra abdominally, five minutes before intravenous injection of thiopental, and (2) intravenously, immediately following induction of anesthesia by thiopental.

No antagonism between these compounds and thiopental was observed. In certain doses and by certain routes of administration, all three succinate derivatives significantly prolonged thiopental anesthesia. When administered alone they produced no signs of depression of the central nervous system.

Sodium succinate given intra abdominally in a dose of 500 mg /kg had no effect on the duration of anesthesia. When given intravenously in a dose of 125 mg /kg, mean anesthesia time was significantly increased. Ethyl succinate produced approximately a twofold prolongation of thiopental anesthesia when 500 mg /kg was given intra abdominally Bis-dimethylaminoethyl succinate, 200 mg /kg intra abdominally, significantly prolonged anesthesia, whereas the same dose intravenously had no influence on duration of anesthesia

Positive Role of the Liver in Rapid Metabolism of Thiopental. Frederick H. Meyers and Don Peoples[7] (Univ of Tennessee) eliminated liver function in dogs by ligating

(6) Anesthesiology 15 122 1 5 March, 1954
(7) Ibid., pp. 146-149

the portal vein and hepatic artery after establishing an Eck fistula. Comparison of the times for recovery from thiopental anesthesia in the hepatectomized animals and sham operated dogs showed a great prolongation of effect resulting from exclusion of the liver These animals did not show signs of awakening during a period at least four times that necessary for sham operated animals to recover

That the hepatectomized animals could have recovered had thiopental been eliminated was shown by two types of experiments (1) One animal was operated on under ether anesthesia and recovered promptly (2) Two animals given an analeptic at the end of the experiment 3½ and 4½ hours after injection of the anesthetic were able to respond by lightening of the anesthesia to a stage of marked excitement

These results support the conclusion that the liver is important in the metabolism of thiopental. The authors believe that tissues other than the liver are quantitatively unimportant in the rapid detoxification of thiopental in dogs

---

VENTILATION

Physiologic Studies Following Thoracic Surgery IV Mechanism of the Development of Acidosis during Anesthesia was studied by W W Stead, F E Martin and N K. Jensen[8] (Minneapolis) Carbon dioxide excretion, total ventilation and alveolar ventilation were determined before and throughout the period of anesthesia in 13 patients who underwent major thoracic surgery By measuring total ventilation, carbon dioxide excretion and carbon dioxide concentration in the alveolar air it was possible to determine the alveolar ventilation Alveolar partial pressure of carbon dioxide (P_{CO_2}) was assumed to be equal to arterial P_{CO_2} The latter was calculated from the pH carbon dioxide content hematocrit reading and hemogl[illegible]in saturation of the arterial blood

It was found that it is the [illegible] air reaching the

(8) J Thorac[illegible] [illegible]5-446 May 1

alveoli which determines acid base balance during surgery (Fig 104) There was no correlation between total ventilation and P_{CO_2} level, probably because of an increased ventilation of dead space during controlled respiration. This phenomenon may have two possible explanations. (1) The respiratory rate may be increased so that with a constant

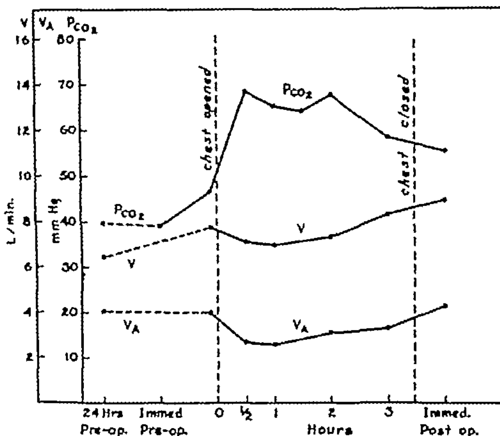


Fig. 104 —Mean values for P_{CO_2}, total ventilation (V) and alveolar ventilation (V_A) before during and immediately after thoracic surgery on 13 patients. Rise in P_{CO_2} was coincident with fall in alveolar ventilation. Total ventilation was well maintained throughout. (Courtesy of Stead W W., et al J Thoracic Surg 25:435-446 May 1953)

dead space the minute volume of dead space ventilation would be increased. (2) The actual volume of dead space of the respiratory tree may be increased. This seems possible, because it is likely that the operated lung is poorly perfused during the time the chest is open. Both of these factors probably play a part because the increase in dead space seemed to occur in two steps (1) at the time of anesthetization when the respiratory rate was controlled by the an

esthesiologist and (2) at the time the chest was opened and one lung was functioning below par

The picture of the acidosis which occurs during anesthesia cannot yet be considered complete, because adequate blood studies of the fixed acids have not been reported. However, the major factor would appear to be the inadequacy of alveolar ventilation during anesthesia.

Practical Physical Method for Detection of Early Respiratory Acidosis during Thoracic Surgery was used by William W Stead, Frank E Martin and John Middlebrook[9] (Minneapolis) on 14 patients under pentothal* curare anesthesia with intermittent manual positive pressure ventilation. Pressure tracings were recorded by means of a strain gauge from the trachea via a polyethylene tube (size 240) inserted through the endotracheal tube

A high degree of correlation was found between the level of arterial P_{CO_2} and presence or absence of spontaneous respiratory efforts. The pressure tracing was flat during pauses of 5 10 seconds in the intermittent positive pressure when P_{CO_2} was normal or low Such pauses were marked by rhythmic negative pressure fluctuations when P_{CO_2} was elevated.

In order to check the dependability of the relationship determinations of arterial P_{CO_2} were made during pauses in positive pressure administration. The highest P_{CO_2} found when endotracheal pressure tracings indicated apnea was 55 mm. Hg The patient showing this elevated threshold was deeply anesthetized. In all other instances there were *spontaneous respiratory efforts when P_{CO_2} reached 45-47* mm. Hg

A patient who had previously shown good correlation with a threshold of P_{CO_2} at 45-47 mm. Hg was purposely anesthetized quite deeply to test the validity of this method In this instance a P_{CO_2} of 80 mm Hg failed to elicit spontaneous efforts, but it could not be determined if the lack of effort were due to paralysis by curare or dulling of the respiratory center by pentothal *

It was found that patients whose P_{CO_2} was maintained near normal during major surgery were more relaxed and

(9) J Thoracic Surg 27 306-314 March, 1954

showed more rapid recovery from anesthesia than those with elevated P_{CO_2}.

In this series acidosis was frequently accompanied by tachycardia, which suggests a toxic effect of acidosis on the myocardium and might explain some cases of cardiac arrest or ventricular fibrillation during anesthesia. Acidosis and anoxia are probably additive in their detrimental effects on the body.

The authors believe that some form of endotracheal pressure tracing would be valuable in teaching the proper technic of intermittent positive pressure respiration. The form of pressure curve clearly shows the manner in which each pressure is applied, the magnitude of pressure reaching the trachea, length of inspiration and expiration, resistance to expiration and rate of respiration. It would also aid in maintenance of a near normal physiologic state with respect to acid base balance.

A suggested improvement in technic, to make it more easily applicable in the operating room, is use of a bright line oscilloscope or a sensitive aneroid manometer instead of a direct writing recorder for detection of spontaneous respiratory efforts.

Electroencephalogram in Evaluation of Effects of Anesthetic Agents and Carbon Dioxide Accumulation during Surgery. Because of the vital cardiovascular control high within the central nervous system, George H. A. Clowes, Jr., Henry E. Kretchmer, Richard W. McBurney and Fiorindo A. Simeone[1] (Western Reserve Univ.) examined the relationship of carbon dioxide and ether on the activity of the central nervous system. Depression of this activity, they reasoned, might well be considered in terms of the degree of narcosis present; carried far enough, this depression might be the cause of such untoward events as cardiac arrest and unexplained hypotension during surgery.

Six reproducible EEG patterns noted at progressively deeper levels of ether anesthesia were regarded as a valid index of the degree of narcosis present in the animals and human beings studied. Significantly less ether in the blood was required to produce a given type of EEG pattern when

(1) Ann. Surg. 138:558-569, October 19[illegible]

arterial carbon dioxide tension was abnormally high than is required when it is normal. This was true particularly at levels of anesthesia at or beyond which the type III EEG pattern appeared. This finding, in both animals and man, suggests that the blood ether concentration and the depressant action of high carbon dioxide tensions summate their effects in producing the total degree of narcosis present at any moment of anesthesia

Changes from the normal ECG pattern were not seen in patients or animals with chests intact until the P_{CO_2} had risen to the point at which the type V EEG pattern was produced. On the other hand, in animals, a decrease in ECG potential was found in all complexes with accompanying ventricular extrasystoles when the oxygen saturation of the blood fell below 20%, whereas little change in EEG pattern was noted until blood levels of 40% oxygen saturation or less were reached

The authors suggest that in difficult or protracted operations (e g, thoracic procedures) in which respiratory difficulty is anticipated, the EEG tracings may serve the good purpose of warning about severe brain depression and collapse They also may shed further light on what parts of a given operation may be expected to give trouble from increased narcosis due to carbon dioxide accumulation.

Regulation of Renal Bicarbonate Reabsorption by Plasma Carbon Dioxide Tension was studied by Arnold S Relman, Benjamin Etsten and William B Schwartz[2] (Boston) In acute metabolic acidosis at plasma bicarbonate concentrations significantly below 25 mEq /L., bicarbonate is completely reabsorbed by the normal kidney and the urine is acid When plasma bicarbonate concentration is elevated above this threshold value, all filtered bicarbonate in excess of the limiting rate is excreted in the urine

In respiratory disturbances of acid base balance however, the bicarbonate threshold must be changed considerably, because in respiratory alkalosis the urine is alkaline despite low plasma bicarbonate concentrations, and in respiratory acidosis it is acid when plasma bicarbonate concentration is high The mechanisms initiating these changes

(2) J Clin. Invest. 32 972 978 October 1953

must operate through a change in either carbon dioxide tension or extracellular fluid pH.

Experiments on the dog have shown (Fig 105) that there is a direct, approximately linear relationship between plasma carbon dioxide tension and renal bicarbonate reabsorption, demonstrable in the presence of extracellular alkalosis and requiring no change in pulmonary ventilation or extracellular pH. The authors suggest that renal adjustment of

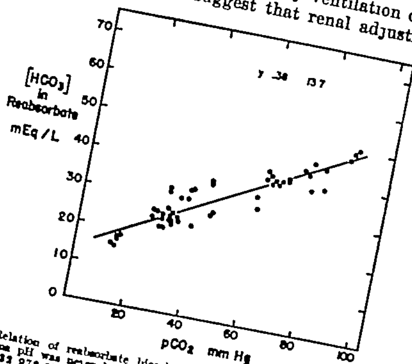


Fig 105.—Relation of reabsorbate bicarbonate concentration to P_{CO_2} for all experiments. Plasma pH was never less than 7 45 (Courtesy of Relman, A. S., et al J Clin. Invest. 32 972-978 October 1953)

bicarbonate reabsorption is related to carbon dioxide tension in a manner which tends to preserve the neutrality of the reabsorbate and the extracellular fluid The mechanism of action of P_{CO_2} on bicarbonate transport is not revealed by these experiments perhaps changes in acidity or carbonic anhydrase activity within the renal tubular cells may be responsible

Intermittent Positive Pressure Breathing Its Use in Inspiratory Phase of Respiration. Inspiratory positive pressure breathing overcomes bronchial resistance and widens the bronchi, helps establish a more efficient cough, creates a more uniform alveolar aeration, thus improving in

trapulmonary mixing, reduces residual volume, improves ventilation perfusion relation through uniform alveolar aeration and decrease in residual volume, prevents or minimizes outward filtration through capillary membrane, and diminishes blood volume returning to the right side of the heart, with subsequent drop in cardiac output and blood supply to the lungs.

M. S Segal, A. Salomon, M. J Dulfano and J A. Herschfus[3] (Tufts College) studied 203 patients with various disorders of the chest who were treated with intermittent positive pressure breathing in the inspiratory phase of respiration (IPPB/I) using the Bennett valve

In 95 patients with bronchial asthma treated with IPPB/I with or without bronchodilator aerosols, respiratory distress was usually diminished However, vital capacity, timed vital capacity and maximal breathing capacity determined immediately after IPPB/I alone were usually less than the control value When a bronchodilator aerosol was combined with IPPB/I, maximal breathing capacity was increased 45 7% over the controls The combination of IPPB/I with a bronchodilator spray was more effective than the bronchodilator aerosol alone

In patients with chronic pulmonary emphysema, less dyspnea and distressing cough after treatment and better exercise tolerance after prolonged treatment with IPPB/I were observed. Vital capacity after IPPB/I alone decreased in most patients. When aerosol was added to the treatment over a prolonged period, average increase in vital capacity *was 31% of the control value The average determinations* during the first five days of treatment (control and after treatment) were similar to those made at the end of a course of treatment Thus it seems that a single treatment gave these patients the maximal improvement in vital capacity However clinical improvement was noticeable and was maintained for a long time after 20-30 days of treatment.

In patients with bronchiectasis, the first treatment was usually followed by copious 24 hour expectoration, which continued for several days until draining was complete

(3) New England J Med 250 225 232 Feb 11 1954

Then cough and expectoration gradually subsided A polymerizing enzyme was of considerable value in treating some of these patients.

Other pulmonary conditions successfully treated with IPPB/I were bronchial and bronchiolar irritation due to gases and fumes, pulmonary edema due to cardiac failure, chest trauma and respiratory depression from barbiturate intoxication.

Pressure-Flow Rate Characteristics of Expiratory Valves With Some Suggested Criteria for an Ideal Valve The expiratory valve in a continuous flow anesthetic system plays an important part in determining the nature and extent of certain physiologic upsets which sometimes accompany inhalation therapy The "setting" of the valve determines the mean pressure in the anesthetic system and in the patient's respiratory tract. This in turn determines the effort required of the patient to expire through the valve and also, indirectly, the size of his physiologic dead space William W Mushin and William W Mapleson[4] (Welsh Nat'l School of Medicine) investigated the behavior and characteristics of (1) the Heidbrink type valve, (2) the E S O chloroform inhaler type valve and (3) the molded rubber valve to determine in what way they fall short of the characteristics desirable in an ideal valve

Six valves of the Heidbrink pattern (Fig 106, *H1* to *H6*) were tested. *H4* was new and unused, but the others were in normal use in operating rooms The E S O valve and the molded rubber valve (*R*) had been used for some time The graphs in Figure 106 show the wide variations encountered in pressure in the different valves for various flow rates. Nearly all Heidbrink valves operate at comparatively high pressures (the exception, *H5*, was found to be defective)

When the Heidbrink valve is closed by up to two of the possible four turns of the knurled screw, the increase in pressure is small for flow rates up to 35 L/minute On closure of the valve by more than two turns, the rate of rise in pressure with flow rate becomes very steep at the higher flow rates It was found that inverting the Heid

(4) Brit. J Anaesth. 26 3 10 January 1954

brink and E S O valves from the upright position decreased the pressure at all measured flow rates The expected decrease in pressure for H2 was estimated from measurement of the weight and surface area of the valve disk and found to be in close agreement with the measured value for that valve Moisture on the H valves increased

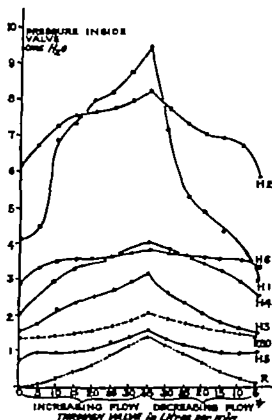


Fig 106—Comparison of pressure-flow rate characteristics of various valves (Courtesy of Mushin W W., and Mapleson, W W: Brit. J Anaesth. 26 3-10 January 1954)

the pressure at flow rates of 5 L/minute, but at higher flow rates the effect was negligible

From these studies the authors conclude that the characteristics of an ideal valve should be such that, when inverted, it would open at a pressure of 0 5-1 0 cm water This opening pressure must be greater than the pressure required to fill the reservoir bag sufficiently for the patient to draw the required tidal volume In addition, a physiologic requirement is that this pressure be exceeded as lit

tle as possible in the upright position and for flow rates up to 30-40 L./minute Theoretically, these requirements would be met by construction of a spring that is very light and long when freed from the valve and by reduction of the weight of the valve disk. Clinical practice suggests that adjustment of the compression spring is an unnecessary facility

[One of the often overlooked, nevertheless critical, factors in resistance to breathing in anesthetic apparatus are the valves. This article points up the deficiencies in some of the commonly used equipment.—Ed.]

CIRCULATION

Some Electroencephalographic Changes Associated with Induced Vascular Hypotension are reported by P R Bromage[5] Hypotension was induced in three conscious subjects by a combination of posture and a vasodilator drug Continuous EEG recordings were made throughout the experiments

In one subject the blood pressure failed to reach critical levels In the other two subjects (one normotensive, one arteriosclerotic), severe hypotension was accompanied by coma, convulsions and profound disturbance of cortical rhythm. Recovery was prompt in a normal volunteer but conspicuously delayed in the arteriosclerotic subject.

Conclusions to be drawn from this investigation of the cerebral circulation and cerebral metabolism in conscious subjects can apply only loosely to the assessment of conditions under general anesthesia Other investigators have shown that under light thiopental narcosis cerebral metabolism is reduced by almost 40%, so that discrepancies between oxygen supply and demand are less likely to occur under anesthesia than in the conscious subject.

In both responding subjects, changes of cortical activity had the quality of suddenness the cortical rhythm changing from normality to gross abnormality over a narrow range of blood pressure In the normal subject the upper limit of the range was 55 mm Hg systolic, and in the arteri

---

(5) Proc Roy Soc Med, 46 919 [illegible] November 1953

osclerotic about 75 mm (a comparable percentage fall of mean arterial pressure)

The difference in recovery in the two subjects may well explain the prolonged recovery times sometimes seen in patients submitted to controlled hypotension It may be that cerebral anoxia is responsible for the prolonged coma.

[Estimates of damage to patients after the use of hypotensive technics are often erroneous because of inadequate measuring methods. The objective evidence of significant changes mentioned in this article should encourage caution in the use of deliberate and profound hypotension.—Ed.]

Effects of Hexamethonium Iodide on Electrocardiograph in Anesthetized Subjects were studied by Mark Swerdlow and Henry J Wade [6] Forty patients were studied, all of whom were undergoing ear, nose and throat operations. Electrocardiographic recordings were taken in the resting state before anesthesia, after induction of anesthesia, after the patient had been placed in a position of 20 degrees reverse Trendelenberg tilt and after the intravenous injection of hexamethonium iodide

The main changes noted on the ECG's were an alteration in the rate and changes in the P wave and P R interval. None of these changes can be considered specific for hexamethonium iodide The alteration in rate was observed without the injection of the drug and was not related to the fall in blood pressure that followed its administration. The disappearance of the P wave and shortening of the P R interval were seen not only following the injection of hexamethonium but also after tilting of the anesthetized subject alone Such tilting of the patient may alter the vasomotor tone, and this could account for the P wave changes The diminution in the P R interval, too, was frequently produced by tilting alone it was not constantly seen after hexamethonium injection. It was not related to the subsequent fall in blood pressure or to tachycardia and is presumably a vagal depressant effect.

The changes in P wave and in P R interval were in every case short lived There was no ECG evidence of structural myocardial change after the use of hexamethonium

(6) Brit J Anaesth. 25 254 290 October 1953

Complications Associated with Use of "Controlled Hypotension" in Anesthesia. The technic of "controlled hypotension," introduced primarily for the prevention of excessive bleeding during surgical operations, has been embraced by an increasing number of anesthetists and surgeons. L. Jennings Hampton and David M. Little, Jr.[7] (Yale Univ.) outline the historical development of this technic.

Gardner's technic of arteriotomy, used initially, approximates a state of hemorrhagic shock and therefore exceeds the bounds of physiologic propriety. A more physiologic method, introduced by Gillies in 1948, consists of preganglionic total sympathetic blockade by the use of spinal anesthesia. Even this technic is admittedly unphysiologic but at least the arteriolar dilatation so produced guarantees normal capillary circulation even in the face of a reduced systemic pressure head, provided the total blood volume is within normal limits and inherent capillary tone remains unaltered. The methonium compounds, introduced in 1948, provided a simple method of sympathetic blockade at the ganglionic level merely by injection. More recently arfonad, a thiophanium compound, and pendiomid have permitted more readily controllable forms of ganglionic blockade. With these methods, proper positioning of the patient is of utmost importance.

With these technics natural concern arises for the adequacy of circulation to vital organs during the period of hypotension. Theoretically, a systolic pressure somewhat exceeding 32 mm. Hg will provide adequate tissue oxygenation when peripheral resistance is removed. This figure must be revised upward for postures in which hydrostatic pressures are important. Exception also must be made for the liver, which secures its blood supply from both arterial and venous channels, and when there is danger of anoxic damage with release of vasodepressor material, if the blood pressure falls below 60 mm. Hg. Apparently coronary circulation is adequate and renal filtration not seriously impaired if systemic arterial pressure remains above 60 mm. Hg.

(7) A.M.A. Arch. Surg. 6: 549-556, October, 1953.

TABLE 1.—Technics Applied to Obtain Controlled Hypotension

	No. Anesthesiologists	No. Cases
Arteriotomy	12	208
Spinal	46	2,655
Methonium compounds	115	3,375
Thiophanium compounds	16	359
Pendiomid	6	63
Others	14	145
Total		6,805

TABLE 2.—Types of Procedure in Which Controlled Hypotension Was Used

	No. Anesthesiologists
Craniotomy	87
Neurosurgical unspecified	30
Head and neck	25
Chest wall (mastectomy)	19
Intrathoracic	12
Cardiovascular	5
Abdominal	20
Pelvic (radical)	31
Orthopedic	8
Plastic	1

TABLE 3.—Complications Encountered in 6,805 Instances of Controlled Hypotension

	No. Cases
Anuria	8
Oliguria	24
Cerebral thrombosis	9
Retinal thrombosis	1
Coronary thrombosis	3
Cardiac arrest	15
Cardiovascular collapse	25
Reactionary hemorrhage	79 (25 mild)
Persistent hypotension	70
Delayed awakening	3
Others	17

TABLE 4.—Comparison of Blood Pressure Levels with Occurrence of Complications in "Controlled Hypotension"

	Below 80 Mm. Hg ([illegible] Cases)	80 Mm. Hg or More ([illegible] Cases)	P	
Anuria	7	0	[illegible]	Significant
Oliguria	17	5	[illegible]	Significant
Cerebral thrombosis	9	0	[illegible]	Significant
Retinal thrombosis	1	0		
Delayed awakening	2	0		
Coronary thrombosis	2	1		
Cardiac arrest	14	1	[illegible]	Highly significant
Cardiovascular collapse	25	0	[illegible]	Highly significant
Reactionary hemorrhage	71	7	[illegible]	Highly significant
Persistent hypotension	63	7	[illegible]	Highly significant

Because complications of "controlled hypotension" were to be expected and yet were not being emphasized, questionnaires were sent to the Diplomates of the American Board of Anesthesiology in order to secure completely anonymous, but unbiased, reports of the results of the technic In all, 144 anesthesiologists reported use of such procedures in 6,805 patients

The technics applied are listed in Table 1, the types of procedure in which the technics were utilized in Table 2, and the complications encountered in Table 3 Table 4 clear-

TABLE 5.—Deaths Occurring in 6,805 Instances of Controlled Hypotension

Cause of Death	No. Cases
Anuria	1
Cerebral thrombosis	4
Cerebral edema	3
Coronary thrombosis	1
Cardiac arrest	2
Cardiovascular collapse	4
Postoperative hemorrhage	6
Persistent hypotension	1
Arterial air embolism	1
Aortic-femoral thrombosis	1
Pulmonary infarcts, edema	2
After high spinal anesthesia	3
Neurosurgical operative trauma	14
Peritonitis	2
Carcinoma with metastases	3
Pre-existing cardiovascular disease	1
Atelectasis	1

ly indicates that in inducing hypotension, 80 mm. Hg is the critical level of systolic pressure above which complications are rare Table 5 enumerates the causes of death among the cases surveyed. It is difficult to establish cause-and-effect relationship between "controlled hypotension" itself and the stated cause of death

Circulatory Effects of Hemorrhage during Prolonged Light Anesthesia in Man H. E de Wardener, B E Miles, G de J Lee H. Churchill Davidson D Wylie and E P Sharpey-Schafer[8] (St. Thomas's Hosp., London) studied the effects of controlled hemorrhage in 14 young, healthy volunteers observed before and during extensive operations for

(8) Clin. Sc. 12:175 184 May 1953

varicose veins Cardiac output, intrathoracic blood volume, forearm blood flow, renal blood flow and glomerular filtration rate were determined

The details of venesections are given in the table and responses to venesection in a typical case in Figure 107 In

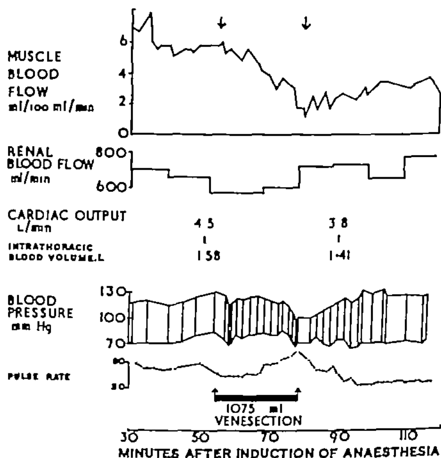


Fig 107 —Results of venesection in one volunteer No correction made for surface area. (Courtesy of de Wardener H. E. *et al.* Clin. Sc. 12 175-184 May 1953.)

these cases cardiac output, forearm blood flow and intrathoracic blood volume decreased, but renal blood flow showed no significant change Changes in blood pressure and pulse rate were small or moderate in 12 cases. In two, blood pressure fell below 40 mm. Hg and the heart rate slowed There was, however, no vasodilatation in forearm vessels

DETAILS OF VENESECTION

Age	Anesthetic	Time after onset anesthetic min.	Total Vol. ml.	Rate first 800 ml. ml./min.	Rate total bleed ml./min.	Vol. ml./kg.	Total blood volume*
34	Ether	95	1460	146	95	18.0	23.5
31	Ether	86	670	70	37	10.6	13.8
32	Ether	97	1260	100	84	14.8	19.3
28	Cyclo	72	1450	50	43	21.0	27.4
21	Cyclo	112	1460	125	104	22.5	29.4
29	Cyclo	90	1440	120	44	18.5	24.1
29	Cyclo	107	1420	77	71	19.0	24.8
28	Cyclo	115	870	55	55	14.0	18.3
32	Cyclo	51	1200	100	60	15.8	20.6
27	Cyclo	54	1075	56	42	16.0	20.9
35	Cyclo	105	1060	57	40	18.0	23.5
37	Cyclo	62	1340	100	39	22.0	28.7
40	Cyclo	59	1060	220	177	11.7	15.3
30	Cyclo	74	1110	75	46	13.4	17.5

* Total blood volume assumed to equal 76.6 ml./kg.

Since loss of blood up to 1,460 ml. in conscious subjects causes vasovagal fainting with muscle vasodilatation, it is suggested that this reaction can be prevented by anesthesia. The evidence further suggests that one of the main mechanisms by which controlled hemorrhage limits bleeding during surgery is by abolishing the vasodilatation produced by the anesthesia.

Evaluation of Vasodilator Mechanisms in Canine Hind leg. Question of Dorsal Root Participation. It is generally agreed that vasoconstriction is brought about by increased sympathetic nervous discharge. Vasodilatation, on the other hand, has been attributed either to inhibition of this discharge or to activation of a number of dilator systems such as the parasympathetic cholinergic dilators or less well defined mechanisms, namely: (a) sympathetic adrenergic, (b) sympathetic cholinergic and (c) dorsal root dilators. The relative importance of these mechanisms in the canine hindleg has not been established and their evaluation forms the basis for the report by M. Jack Frumin, S. H. Ngai and S. C. Wang[9] (Columbia Univ.).

(9) Am. J. Physiol. 173: 428-436. June 1953.

Vasodilatation was produced in the hindleg of the anesthetized dog by stimulation of the peripheral portion of sectioned spinal roots, the carotid or aortic baroceptors or the medullary vasodepressor center The vasomotor responses were evaluated by recording the femoral arterial flow rate with a rotameter type of flowmeter, together with the systemic arterial pressure The perfusion pressure was always maintained at a stable level and a cross-circulation system was used for this purpose during reflex hypotension.

Hydergine, an adrenergic blocking compound closely related to ergotoxine, abolished the constrictor response to ventral root stimulation whereas large doses of atropine abolished the dilator response to ventral and dorsal root stimulation. These results confirmed the existence of sympathetic adrenergic constrictor, sympathetic cholinergic dilator and dorsal root dilator fibers. The vasodilator response to reflex stimulation was entirely abolished by lumbar chain ganglionectomy or hydergine but was not affected by atropine or surgical elimination of the dorsal root system.

The authors conclude that the only mechanism for eliciting dilatation through medullary reflexes is inhibition of sympathetic discharge There is no evidence that the dorsal roots or the sympathetic vasodilators participate in these reflexes

Qualitative Difference between Levoepinephrine and Levoarterenol Experimental Demonstration. George M Sanderson, Jr, and Roger S Hubbard[1] (Buffalo) compared the effects of levoarterenol and levoepinephrine on arterial, portal venous and right auricular pressures and on cardiac rate in mongrel dogs The agents were administered by way of the portal or the jugular vein, in group 1, 13 dogs were studied following single injections and in group 2 (11 dogs) the effects of continuous infusion were noted.

In group 1 levoarterenol elevated both arterial and portal pressures. As the effect of the agent was dissipated the pressures gradually returned to the original base line Levoepinephrine when administered via the portal vein, caused an immediate rise in portal pressure, but arterial pressure

(1) A.M.A Arch. Surg 67 746 752 November 1953.

either showed no change or fluctuated erratically When given systemically, epinephrine caused significant elevations in both portal and systemic pressures Then, while portal pressure slowly returned to the base line, arterial pressure dropped precipitously below the base line before gradually returning to normal

Tachycardia was produced by levoepinephrine administered by either route, bradycardia resulted from levoarterenol administration in the same manner

In group 2, portal pressure was elevated by each agent irrespective of the route of administration Arterial pressure was consistently elevated by levoarterenol but depressed by levoepinephrine Cardiac rate was slowed by levoarterenol, but levoepinephrine caused transient tachycardia.

The authors suggest the following thesis, based on the qualitative differences noted arterenol is a vasoexcitor substance, whereas epinephrine is a vasoinhibitor substance demethylation at some site in the body, possibly the liver, effects a transformation of epinephrine into arterenol as the vascular system demands to maintain normal tone

When arterenol is introduced into either the portal or the systemic circulation a rise in portal and arterial pressures effected which corresponds roughly to the magnitude of the dose given and can be explained on the basis of pure vasoconstrictor action. If epinephrine acts on the peripheral systemic arteriolar bed as a dilating agent, the fall in pressure which has been noted can be explained in a reduction in the resistance to outflow Then if, on reaching the liver, epinephrine is demethylated and transformed into arterenol, vasoconstriction of the hepatic venules causes an increased resistance to portal outflow as the newly manufactured arterenol acts upon the first area it reaches Therefore the elevation in portal pressure can be explained

Heart Force Responses to Pressor Amines during Hypotension Produced by Hexamethonium in dogs was studied by M. deV Cotten, J M Brown and P S Kronen[2] (Med. College of South Carolina) Under light anesthesia hexa

(2) Anesthesiology 15 126-133 March, 1954

methonium produced a substantial fall in blood pressure and in cardiac contractile force (as measured with strain gauge arches) and rate A substantial increase in arterial pressure resulted from intravenous administration of each of five pressor amines The contractile force of the heart was substantially increased by l arterenol and moderately increased by ephedrine and methamphetamine Phenyl ephrine and methoxamine produced only minimal increase in heart force.

The increments in heart force produced by l arterenol, ephedrine and methamphetamine are considered to represent actual drug produced increases The small increments in heart force produced by phenylephrine and methoxamine are considered to be largely or entirely responses to hyper tension and not the result of direct stimulation of the myocardium

The selection of a pressor amine to combat hypotension should be based on knowledge of its cardiac activity as well as its peripheral vascular actions. In conditions of hypotension associated with weakened myocardium, pressor amines such as l arterenol, methamphetamine and ephed rine are indicated, since they increase heart force as well as pressor responses.

[It becomes increasingly evident that the use of pressor amines must be selective and that there is definite advantage in making as accurate an assessment of the nature of hypotension as possible before administering pressor drugs.—Ed.]

Cardiac Arrest after Intravenous Administration of Procaine Amide (Pronestyl®) William Weingarten, Nicholas J Galluzzi and Alexander A. Doerner[3] (U S Pub Health Service) report a case in which recovery occurred

Man, 30, underwent right upper lobectomy for tuberculosis. Endotracheal anesthesia was induced with ether and continued with cyclopropane and oxygen. A slow intravenous drip of procaine hydrochloride was given continuously as a prophylactic measure against cardiac arrhythmias. Hexamethonium chloride was given intravenously to control hypertension that developed after intubation The operation progressed uneventfully for about five hours, when the pulse became irregular An ECG revealed multiple premature ven tricular contractions from the same focus and ventricular tachy cardia. After 250 mg procaine amide was given intravenously the

(3) J A M A 154 955 956 Mar 20 1954

QRS complexes widened within one minute. Ten minutes later they had returned to their previous duration, because ventricular tachycardia persisted and the patient's condition seemed precarious, 150 mg procaine amide was given. Five minutes later, as there was no change in the ECG or the patient's condition, 200 mg procaine amide was given. Within one minute, QRS widening again appeared. Four minutes later the QRS complexes had returned to their original duration and 200 mg procaine amide was administered, with subsequent widening of the QRS complexes. Five minutes later, although slight QRS widening persisted, in view of the patient's lack of response, 250 mg procaine amide was given. During the next few minutes progressive QRS widening occurred, and cardiac standstill supervened. The exposed heart was immediately massaged manually and epinephrine injected into the left ventricle. About 15 minutes later, spontaneous ventricular contractions were observed and the continuous ECG demonstrated a reversion to normal in reverse order o the pattern of evolution of the cardiac standstill. The patient made an uneventful recovery, and several days later a follow up ECG revealed an entirely normal pattern

Although the patient received a variety of drugs preoperatively and during anesthesia, which also may have precipitated the bout of ventricular tachycardia and contributed to cardiac arrest, the authors believe, in view of the fact that the continuous ECG tracings revealed immediate changes after each dose of procaine amide, that the relation between intravenous administration of this drug and cardiac arrest is well established.

New Inventions Continuous Blood Pressure Indication. D M. Downing[4] (Belfast) describes an apparatus which provides a continuous easily visible indication of systolic and diastolic pressures The radial pulse is readily counted from the indicator The equipment is electrically operated, but the voltages and currents involved are well within the recognized safety ranges when explosive gases or vapors are in use

The principle of operation of this device is based on the fact that if very finely powdered carbon is lightly compressed between two electrodes, the resistance between the electrodes, which is mainly due to contact resistance between the carbon particles, varies inversely with the pressure exerted on the carbon. When a current is passed through such a device connected in series with a suitable

(4) Anaesthesia 9:35-37 January 1954

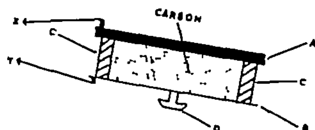
meter, the variations in current due to the varying pressure can be measured, and the currents will bear a constant relationship to the pressures.

APPARATUS.—Figure 108 shows the receptor, the basic construction of the receptor and the associated circuit is shown in Figure 109. Finely powdered carbon is lightly packed into the space between the thick metal plate *A* and the thin flexible metal plate *B*, surrounded by the annulus of insulating material *C*. Plates *A* and *B* *form the electrodes and the flexible plate B has a button D fixed to* its center. This unit is connected by a flex which may be of any length to the indicating meter and battery. The 1.5 volt cell and the



Fig. 108.—Receptor. (Courtesy of Downing, D. M.: Anesthesia, 9: 35-37, January, 1954.)

500 ohm potentiometer provide a means of energizing the system and varying the basic current supplied to it. The total current drawn from the cell is approximately 5 ma. *The meter is of the moving* coil type with a basic full scale deflection of 1 ma. It is shunted to read 5 ma. full scale, the damping of the needle thus produced being about optimal for the range of pulse rates likely to be encountered. The scale is directly calibrated in millimeters of mercury, the calibration points being obtained by placing the receptor under a sphygmomanometer cuff applied to a roll of gauze. To avoid cramping the scale unduly it is arranged to read 200 mm. Hg at full deflection with the potentiometer adjusted suitably. *The potentiometer* setting is not touched during subsequent calibration. The graduations are of the inverse logarithmic type.



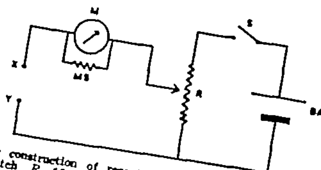


Fig. 109.—Basic construction of receptor and associated circuit *BA*, 1.5 volt cell *S* toggle switch *R* 500 ohm potentiometer *M* 0-1 ma. meter *MS* meter shunt. (Courtesy of Downing D M Anesthesia 9 35-37 January 1954.)

To use, the receptor is lightly strapped to the patient's wrist with the button *D* over the radial artery proximal to the styloid process of the radius The flex is plugged into the meter unit, the battery switched on and the potentiometer set so that the systolic (or diastolic) pressure indicated agrees with that previously determined by sphygmomanometer The meter needle oscillates at the pulse rate (which is thus easily counted) between systolic and diastolic pressures.

Blood Flow in Human Muscle during Cyclopropane Anesthesia is increased during light anesthesia and decreased during deep anesthesia. A. H. Kitchin, O Sanger, H. E

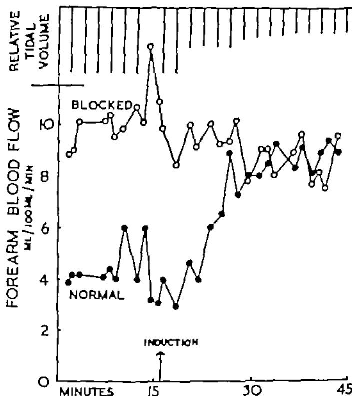


Fig 110 —Vasodilator action of light anesthesia on normal arm and absence of any change in blood flow in nerve-blocked forearm. (Courtesy of Kitchin, A. H., *et al.*: Clin. Sc. 12 361 366 November 1953)

de Wardener and I Maureen Young[5] (St Thomas's Hosp., London) studied the mechanism responsible for these changes by comparing simultaneous measurements of blood flow in the two forearms of seven patients during varicose vein ligation under endotracheal cyclopropane anesthesia In one of the forearms innervation of the muscle blood vessels was interrupted by a deep nerve block

Figure 110 indicates forearm blood during light anes-

(5) Clin. Sc. 12 361 366 November 1953

thesia and Figure 111 the flow as affected by deep anesthesia. The rise in blood flow during light anesthesia in the normal forearm only shows that the dilatation is dependent on an intact nerve supply. It may be due to inhibition of sympathetic vasoconstriction by the cyclopropane.

The reduction in blood flow during deep anesthesia in both arms is not due to a fall in arterial blood pressure or to anoxia (arterial oxygen saturation was measured in two

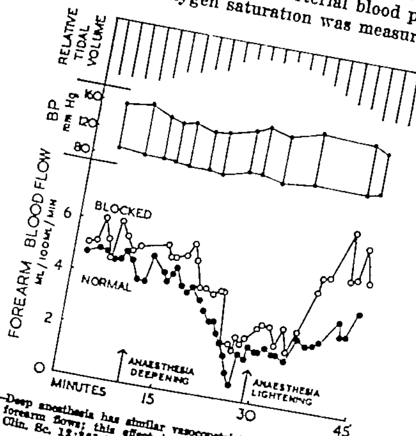


Fig 111.—Deep anesthesia has similar vasoconstrictor action on both normal and nerve-blocked forearm flows; this effect is quickly reversible. (Courtesy of Kitchin, A. H., *et al.*: Clin. Sc. 12:361-366 November 1953)

patients) Nor does it seem likely that the constriction was caused primarily by the high degree of carbon dioxide accumulation during deep anesthesia, for there was no alteration in blood flow when the alveolar carbon dioxide concentration was allowed to rise for a comparable period to even higher levels by removing the CO_2 absorber from the cyclopropane circuit during light anesthesia (Fig 112)

The authors suggest that the vasoconstriction during deep anesthesia is due either to a disturbing action of the high

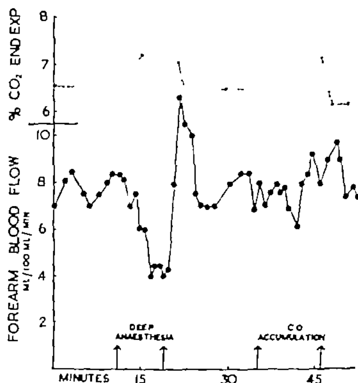


Fig 112 —Effect of CO_2 accumulation, as result of (1) deepening the anesthesia, (2) removing the CO_2 absorber from the cyclopropane circuit during light anesthesia, on blood flow in normal arm. "% CO_2 End Exp." refers to CO_2 content of alveolar air (Courtesy of Kitchin A. H., *et al* Clin Sc. 12 361-366 November 1953)

concentration of cyclopropane on the metabolism of the blood vessel walls or to the release of a vasoconstrictor substance either locally or at other sites

Bleeding from Cut Skin and Subcutaneous Tissue Surfaces during Cyclopropane Anesthesia. An investigation was carried out by George McLoughlin[6] (United Liverpool Hosp) to determine and compare the blood loss from standard skin punctures during cyclopropane and ether anesthesia. Blood loss was estimated by measuring the area of blood collected on a filter paper from a puncture made with an automatic lancet, the result being expressed in square centimeters The mean preoperative blood loss for 150 patients was 1 80 sq cm

In planes 1 and 2 of cyclopropane anesthesia, the amount of bleeding was inversely proportional to depth of anesthesia. In the deeper anesthesia of planes 3-4 blood loss

(6) Brit. J Anaesth. 26 84-89 March 1954

was correlated with both aided and spontaneous respiration.

Comparison of the mean blood loss ratios in plane 2 of cyclopropane and ether anesthesia showed that at this depth there was approximately 1½ times as much bleeding with cyclopropane as with ether Other investigators have shown that cardiac output is greater for any given plane of anesthesia when cyclopropane rather than ether is used This increased cardiac output acting through a passively dilated peripheral vascular field such as has been shown to occur with both agents, must be an important factor in producing the increased bleeding during cyclopropane anesthesia

The data obtained suggest that excessive bleeding from cut surfaces during cyclopropane anesthesia can be reduced considerably if a respiratory pattern with adequate tidal volume is maintained throughout anesthesia and the lightness of plane 1 is avoided Since the agent depresses respiration progressively as anesthesia deepens and, further, since this depression commences as early as plane 1 of stage 3 satisfactory gaseous exchange with adequate removal of carbon dioxide can be obtained only by aiding respiration from the beginning of anesthesia.

Effects of General Anesthesia, and Hexamethonium, on Blood Sugar in Nondiabetic and Diabetic Surgical Patients were studied by J A. Griffiths[7] (Sheffield England) after two diabetic patients had severe hypoglycemia toward the end of surgery in which the technic of controlled hypotension for the reduction of blood loss was used

The anesthetic technic consisted of induction with 5% thiopental sodium and gallamine triethiodide given intravenously inflation with oxygen and orotracheal intubation Maintenance was by nitrous oxide-oxygen (60 40%) on the semiclosed circuit with carbon dioxide circle absorption, supplemented by pethidine intravenously, and further doses of gallamine when required Respiration was assisted when necessary to insure full oxygenation at all times

In selected nondiabetic patients the following results were obtained (Fig 113) During superficial operations on 20 subjects blood sugar values remained constant through

(7) Quart. J Med. 88 405-418 October 1952

out. Upper abdominal section in 10 patients produced a maintained rise of the blood sugar level which was statistically significant but clinically unimportant During superficial operations on 25 patients under induced hypotension with hexamethonium bromide, the blood sugar decreased after hexamethonium was given, remaining stable at this lower level.

In two nondiabetic patients hexamethonium greatly potentiated the action of parenteral insulin, causing severe

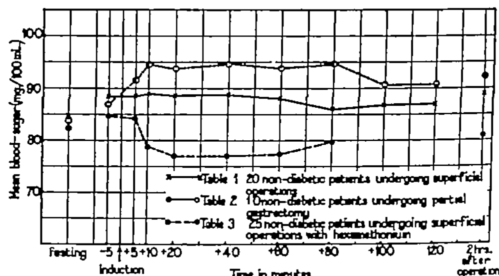


Fig. 113 —Mean blood sugar values in three groups of patients showing (1) steady level of blood sugar in superficial operations; (2) significant but clinically unimportant increase of blood sugar in partial gastrectomies; (3) lowering of blood sugar level after administration of hexamethonium to induce hypotension. (Courtesy of Griffiths, J A. Quart. J Med. 88:405-418 October 1953)

hypoglycemia. Three patients with controlled diabetes had stable blood sugar values with the standard anesthetic technic Considerable potentiation of insulin occurred in one further diabetic patient in whom hypotension was induced with hexamethonium (Fig 114)

It was noted that hexamethonium in the anesthetized subject masked many of the signs of hypoglycemia, even when severe The only constant sign was progressive tachycardia. The author concludes that controlled hypotension with hexamethonium is strongly contraindicated in diabetic patients because of (1) the common complication of peripheral

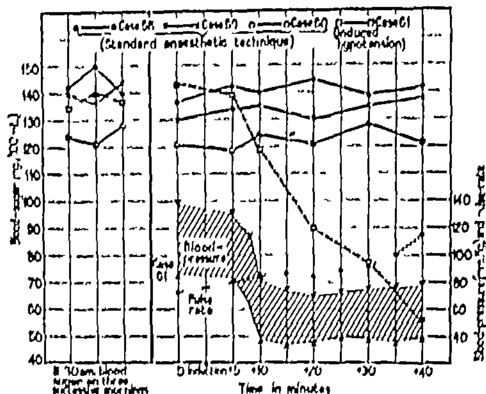


Fig. 111. Blood sugar values in four patients with controlled diabetes during general anesthesia for superficial operations showing striking fall in blood sugar level in patient who received hexamethonium (Case 61). Only sign of this degree of hypoglycemia was progressive tachycardia. (Courtesy of Griffiths, J. A.: Quart. J. Med. [illegible] October, 19[illegible].)

vascular disease in such patients and (2) the danger of severe hypoglycemia with possible resultant acute coronary insufficiency or central nervous system damage.

Effect of Ether on Cyclopropane-Epinephrine Arrhythmias in mongrel dogs was studied by E. M. Greisheimer, M. J. Oppenheimer, D. W. Ellis, P. R. Lynch and L. Shapiro[8] (Temple Univ.). Pulmonary arterial and aortic blood pressures were recorded simultaneously with ECG's by three unipolar leads before, during and after the injection of epinephrine under cyclopropane oxygen and ether cyclopropane oxygen endotracheal anesthesia. The concentration of cyclopropane and ether in blood in the presence of each other was determined (Table 1). In some experiments, oxygen and carbon dioxide contents of whole blood were also

(8) Anesthesiology 15:51-60, January 1954.

determined (Table 2) The epinephrine induced arrhythmias were not apparently attributable to either hypoxia or hypercarbia

In 13 of the 18 experiments, the epinephrine-induced ar

TABLE 1 — CYCLOPROPANE AND ETHER CONCENTRATIONS IN ARTERIAL BLOOD

	Concentration of cyclopropane in blood at time of first injection of epinephrine; mg. %			Concentration of cyclopropane in blood at time of last injection of epinephrine; mg. %			Concentration of ether in blood at time of last injection of epinephrine; mg. %		
	Min.	Max	A	Min.	Max.	A	Min	Max.	A
Arrhythmias prevented 13 dogs	7.43	15.77	11.60	6.16	16.62	11.64	18.74	124.30	58.49
Duration of administration in minutes	18	123	42.8	13	63	31.8	13	63	31.8
Arrhythmias not prevented 5 dogs	5.52	17.59	11.80	6.50	13.04	10.72	29.5	57.8	46.9
Duration of administration in minutes	20	75	48	18	78	42.7	18	78	42.7
Ventricular fibrillation after first injection 15 dogs	7.04	14.56	11.84						
Duration of administration in minutes	22	166	59.7						

* Averages given are simple averages (arithmetic means) obtained by dividing sum of observations by number of observations.

TABLE 2 — OXYGEN AND CARBON DIOXIDE CONTENT OF ARTERIAL BLOOD

	Oxygen, volumes per cent			Carbon Dioxide, volumes per cent (whole blood)		
	Minimum	Maximum	Average*	Minimum	Maximum	Average*
16 dogs breathing spontaneously after sodium thiopental	12.8	18.9	15.2	29.7 [illegible]	45.5	38.8
After 40 min. on cyclopropane-oxygen	15.0	25.2	20.1	27.2	48.8	35.6
After 30 min. on ether-cyclopropane-oxygen	15.7	23.8	20.3	29.1	42.8	35.0
7 dogs requiring artificial respiration for a part of the time	12.0	26.6 [illegible]	17.8	35.0	58.3 [illegible]	42.8
After 40 min. on cyclopropane-oxygen	16.3	26.5	20.6	29.8	58.5	44.7
After 30 min. on ether-cyclopropane-oxygen	14.5	25.6	19.1	31.5	57.5	44.1

* Averages given are simple averages (arithmetic means) obtained by dividing the sum of the observations by the number of observations.

rhythmias were prevented by administration of ether The first ectopic beat of a bout of arrhythmias, following the *first injection of epinephrine* originated most frequently in the upper anterior right ventricle The commonest irregularity noted was a bigeminal rhythm This consisted of a

normal beat followed by a ventricular premature systole It was observed that during the ventricular systole of ectopic origin the pressure developed in the right ventricle opened the pulmonary semilunar valve, but that in the left ventricle was insufficient to open the aortic semilunar valve The bradycardia often noted in the peripheral pulse during cyclopropane-oxygen anesthesia may be due to this

Cardiovascular Effects of Continuous Intravenous Infusion of Nor-epinephrine, Epinephrine and Neo-synephrine* during Cyclopropane and Ether Anesthesia in the Dog were studied by Ralph A Deterling Jr, S H. Ngai John H. Laragh and E M. Papper[9] (Columbia Univ) Seven dogs were used for the study Each dog was challenged with continuously infused vasopressor amines during anesthesia The same experiments were repeated on each dog after a rest period of one week Ether or cyclopropane was used luring the first experiment, to be followed by the other nesthetic agent the following week Thus each dog served s its own control After thiopental sodium induction, an dotracheal tube was inserted and connected to a closed to-and fro rebreathing absorption system Anesthesia was maintained at the third plane of surgical anesthesia

The simultaneous administration of cyclopropane and nor-epinephrine or epinephrine resulted frequently in serious ventricular arrhythmias, whereas a sinus rhythm was maintained during the combined administration of ether and these vasopressor amines In contrast, neo-synephrine* infusions did not cause ventricular arrhythmias during cyclopropane anesthesia

It was noted that in comparable dosage nor-epinephrine provoked ventricular arrhythmias more frequently than epinephrine during cyclopropane anesthesia It also raised the arterial pressure more than did epinephrine Elevation of the arterial pressure is not the most important factor in the production of arrhythmias since significant increases in pressure occurred with neo-synephrine* without ventricular arrhythmia.

(9) Anesthesiology 15 11 18 January 1954

Endotracheal Anesthesia for Tonsillectomy and Adenoidectomy in Children is strongly recommended by John W Pender and O Erik Hallberg[1] (Mayo Clinic) The advantages of endotracheal anesthesia for this type of surgery include (1) a continuously patent airway, (2) nonvarying level of anesthesia which may be kept light so that protective laryngeal reflexes become active rapidly after operation, (3) diminished likelihood of aspiration of blood and

RELATION OF TUBE SIZE TO AGE OF CHILD IN ENDOTRACHEAL ANESTHESIA

Age, Yr	Total Cases	Tube Size (French)											
		16	18	20	22	24	26	27	28	29	30	32	33
1- 2	16		8	5	2	1							
2- 3	48		10	31	6	1							
3- 4	118	1	5	42	55	10	4		1				
4- 5	128		6	20	47	40	14	1					
5- 6	135			14	32	47	38	4					
6- 7	166		1	12	24	50	62	17					
7- 8	99			4	15	30	36	14					
8- 9	75		1		3	24	33	11	3				
9-10	39				2	9	13	14	1				
10-11	37			1		9	16	8	3				
11-12	31					6	9	10	4		1	1	
12-13	41					3	11	19	5	2	1		
13-14	34					3	9	10	9	1	1		1
14-15	12						2	5	3	1	1		
Total	969	1	34	130	183	233	247	113	29	4	4	1	1

other foreign material and (4) improvement in visualization of the field of operation because freedom of retraction of the tongue is allowed by the presence of the tube

The disadvantages encountered by the authors were few and infrequent in the 1,050 intubations reported. In two instances the endotracheal tube was displaced from the larynx during the operation. The one possible disadvantage of this type of anesthesia is that the services of a trained anesthetist are required

To avoid complications the authors suggest four general rules to be followed in intubating young patients (1) Avoid trauma, moderately deep anesthesia with a potent agent is mandatory Once the tube is in place, very

(1) J.A.M.A. 152 1072 1074 Nov 21 1953

light anesthesia is all that is needed. (2) Select endotracheal tube of correct size (The table shows the sizes of endotracheal tubes used for the various age groups) A rather wide range of tube sizes was necessary to obtain the proper fit of tube to larynx. (3) Avoid motion of the tube in the larynx, remove the tube as soon as the patient begins to swallow, since coughing and swallowing with the tube in place may traumatize the larynx. (4) Use only chemically and bacteriologically clean tubes

Anesthesia Technic for Excisional Pulmonary Surgery Experiences with Iproniazid. The management of anesthesia in patients with far advanced tuberculosis is described by H. Egon Susbac and Mortimer B Genauer[2] (Staten Island, N Y) Particularly interesting was their experience with the effect of isonicotinic acid hydrazine derivatives on the administration of anesthesia.

Isoniazid presented no problem in over 40 cases Iproniazid however, presented a challenge It is more toxic than isoniazid, and causes such neurologic complications as dizziness, vertigo, hyper reflexia, clonic muscular contractions, peripheral neuritis, numbness and paresthesias In four of six iproniazid treated patients, surgery had to be canceled following induction of anesthesia because of the development of severe neurologic manifestations (hyper reflexia, clonic muscular contractions and abnormal neurologic signs) and disturbances in the heat regulating mechanism (temperatures over 106 F were recorded) In a fifth patient, deep anesthesia abolished the mild hyper reflexia that developed during induction The sixth showed no unusual neurologic signs and was the only patient who had not had topical anesthesia with cocaine before intubation.

The authors believe that not only cocaine but any sympathomimetic drug or even a depressant drug whose initial effect is temporary stimulation of the central nervous system will increase the hyperirritability produced by iproniazid. Although the drug disappears almost completely from the blood stream within 24 hours after it has been discontinued, it apparently is stored in nerve tissue at least 3 or more weeks (increased nervous irritability has been ob

(2) Quart. Bull. Sea View Hosp. 14 110-127 July 1953

served for this period of time) For this reason it is recommended that iproniazid therapy be discontinued for at least four weeks before any surgical intervention.

Renal Function during General Anesthesia and Operation is discussed by E. M. Papper[3] (Columbia Univ) General anesthesia produces a stereotyped response in the kidney, depending somewhat on the depth of anesthesia, the agent used and the premedication given. A striking intrarenal vasoconstriction occurs associated with a fall in glomerular filtration and a reduction in urinary concentration and excretion of electrolytes and water There appears to be a relative increase in renal tubular reabsorption of both electrolytes and water Since these renal hemodynamic changes resemble changes seen with a variety of clinical situations such as congestive heart failure, violent exercise, pain, chronic anemia and shock, they may be the result of a homeostatic influence of stress The mechanism of their production is obscure The trauma of operation has no influence, since the changes occur during anesthesia without operation and tend to decrease as operation progresses, if there is no shock or hemorrhage Since the renal vascular changes are rapidly reversible after termination of anesthesia, drugs probably have little significant direct action on the renal circulation.

The anesthetic agent per se is probably not implicated in postoperative derangements of urine formation and electrolyte control. Moyer believes that these changes are probably due to distributional shifts of body fluids and afferent stimuli from the operative area. Although it is reasonable to assume that postoperative changes are not caused by a defect in glomerular filtration, it is possible that the renal tubules have been conditioned in some manner by anesthesia or operation or both, so that they do not function adequately with regard to water and salt loads in the postoperative period.

Chronic venous congestion may cause the kidney to retain abnormal amounts of sodium by increased tubular reabsorption Venous congestion or dilatation during anesthesia is not uncommon.

(3) J.A.M.A. 152 1686-1689 Aug. 29 1953

The influence on renal function of induced hypotension produced during anesthesia with autonomic ganglionic blocking agents has been studied It was found that renal plasma flow was well maintained despite considerable reduction of arterial pressure

Contact Ulcer Granuloma and Other Laryngeal Complications of Endotracheal Anesthesia. Authors of early reports on laryngeal granuloma as a sequel to endotracheal anesthesia regarded it as a newly discovered lesion However, Chevalier Jackson[4] points out that contact ulcer granuloma has been known to laryngologists as a definite disease entity for many years One clinic reported 249 cases, none of them associated with either endotracheal anesthesia or any form of instrumental trauma.

Contact ulcer granuloma usually occurs at the tip of the vocal process of one or both arytenoids There are three reasons why nonspecific laryngeal ulcer is so localized (1) the extremely thin mucoperichondrial covering of these tips (2) the incessant movement of the arytenoids, and (3) the constant and powerful projection into the lumen of the airway and the hammering together of the cartilaginous points

Trauma to the tips of the vocal processes of the arytenoids results primarily from scraping because the tube is introduced before laryngeal reflexes are abolished or lightening of anesthesia allows these reflexes to reappear, from hooking of the vocal processes by the slanted open end of the tube during intubation from the rubbing of the arytenoids against the tube because physiologic movements have not been abolished by safe degrees of anesthesia (Fig 115), from recoil on an elastic anesthesia tube because the upper end is fixed in the nose or pharynx, adding to the up-and down movement, and from use of a roughened tube, which would greatly intensify the trauma due to rubbing

The exciting initial causes producing contact ulcer or perpetuating factors causing contact ulcer granuloma by interfering with healing are laryngeal movements, hammer and anvil trauma (impact of hammering of the cartilaginous vocal process of one arytenoid against that of the op

(4) Anesthesiology 14 425-436 September 1953.

posite arytenoid), cough, vocal abuse and "throaty" voice

Logically, the two phases of prophylaxis are the prevention of direct trauma by skilled and gentle introduction and by meticulous care and inspection of the tube, and prevention of granuloma formation by a regimen of silence to insure prompt healing Early diagnosis of trauma is therefore essential Whether a contact ulcer granuloma is incidental to endotracheal anesthesia or due to other causes, the prognosis with proper treatment is good With early diagnosis, a good voice may be expected

The second most serious laryngeal complication is acute

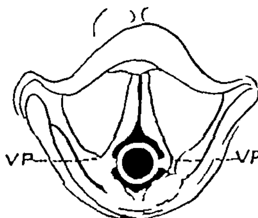


Fig 115—How vocal processes (*VP*) of arytenoid cartilages of each side rub against surface of endotracheal anesthesia tube in ceaseless physiologic movements of the arytenoids. (Courtesy of Jackson C: Anesthesiology 14:425-436 September 1953)

edematous stenosis This is most likely to occur in children for two anatomic reasons—the abundance of loose areolar tissue in the subglottic region, and the small lumen which is occluded by very little swelling The cardinal signs of obstructive laryngeal dyspnea are (1) indrawing at any one or more of the following locations, suprasternal notch, around the clavicles or epigastrium, (2) ashy gray pallor, (3) choking, gagging and waking in terror every time the child falls asleep, and (4) restlessness. Sedation is contraindicated, and immediate low tracheotomy is imperative

Nomenclature for Methods of Inhalation Anesthesia is presented by Jack Moyers[5] (State Univ of Iowa) based on

(5) Anesthesiology 14:609-611 November 1953

the concept that all inhalation systems and technics either do or do not utilize a reservoir bag and all methods either provide rebreathing or preclude it

	Reservoir	Rebreathing
Open	no	no
Semiopen	yes	no
Semiclosed	yes	yes, partial
Closed	yes	yes, complete

The selection of a technic involves a consideration of several measurable factors the proper application of which greatly influences the success of the anesthetic procedure Among these are heat loss, humidity of inspired gas, carbon dioxide retention and resistance to respiration.

In the open system, air is available, therefore moisture loss is no problem Heat loss is a factor Resistance to respiration is minimal and carbon dioxide is not retained.

In the semiopen system, a reservoir of anesthetic gases is used and rebreathing is not allowed Carbon dioxide accumulation is avoided. Water and heat are lost. In properly cared for equipment, resistance to respiration should be minimal. Unclean valves, however, can produce considerable resistance

In the semiclosed system, the rebreathing involved allows reduction of moisture and heat loss Resistance will be increased by a valve system and by the necessary inflation of the rebreathing bag on expiration Absorption of carbon dioxide must be provided.

The closed system minimizes heat and water loss, particularly in the to-and fro absorption method. The amount of resistance is determined by the equipment used but will certainly be more than with the open or semiopen system The absorption of carbon dioxide is obligatory

Semiclosed Inhalers Studies of Oxygen and Carbon Dioxide Tensions during Various Conditions of Use The growing popularity of nitrous oxide, combined with a basal narcotic of a barbiturate intravenously and a muscle relaxant, has once again brought the semiclosed technic to the fore Recent investigations have proved that serious physiologic and metabolic derangements may occur during anesthesia and surgery even with the proper use of an apparatus by

a skilled person Since published data on the basic princi ples and proper operation of the semiclosed inhaler are meager, Curtis H Swartz, John Adriani and Alexander Mih[6] (Louisiana State Univ) studied this aspect of anes

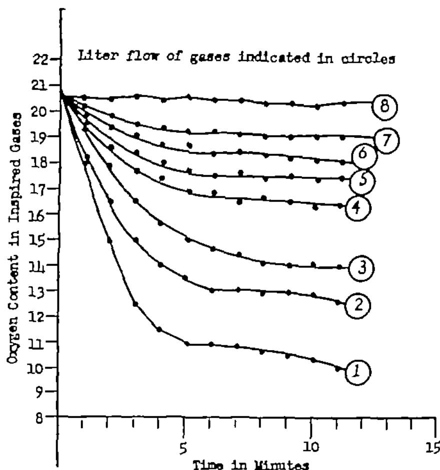


Fig 116—Oxygen tension under mask at lips with use of Foregger single canister circle filter Figures in the circles indicate liters flow of compressed air/minute into inhaler Curves are typical of data obtained when the Heidbrink and McKesson circle filters are used as semiclosed inhalers. It also typifies tensions obtained when to-and-fro inhaler is used in semiclosed manner Changes obtained when helium-oxygen mixtures are used also follow this pattern. (Courtesy of Swartz, C. H. *et al* Anesthesiology 14 437-448, September 1953)

thesia and inhalation therapy in detail in both nonanesthetized and anesthetized subjects. Oxygen, air helium-oxygen and nitrous oxide-oxygen were delivered into currently available semiclosed inhalers at various rates of flow

Oxygen tension under the mask at the lips at various rates of flow is charted in Figure 116 and the concomitant

(6) Anesthesiology 14 437-448 September 1953.

parallel fall in blood oxygen tension in Figure 117 The size and *total capacity of the inhaler had no influence on results*, nor did the position of the exhalation valve (on the canister instead of directly on the mask) Some rebreath

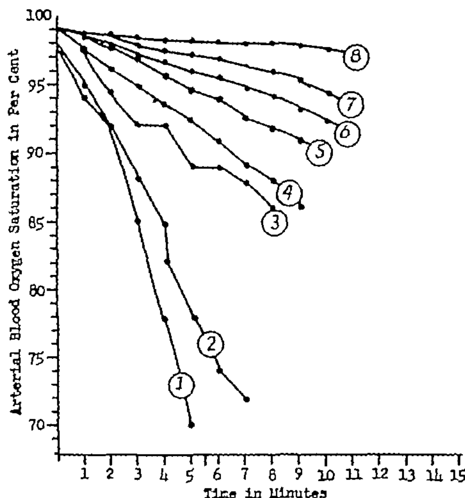


Fig. 117 —Arterial oxygen saturation parallels oxygen tension in inspired air under circumstances described in Figure 116. Similar patterns were obtained with use of Heidbrink McKesson to-and-fro filters and helium-oxygen mixtures in Foregger single canister circle filter Figures in circles indicate flow of air in liters/minute. (Courtesy of Swartz, O. H., *et al.*: Anesthesiology 14 437-448 September 1953)

ing is inevitable in the semiclosed inhaler unless it is one based on the demand principle It is obvious from the data summarized graphically in Figure 118 that unless high rates of flow are maintained, a carbon dioxide absorber is necessary for all semiclosed inhalers except those functioning on the demand principle Comparison of the data in Figure 119 with the other data indicate identical patterns of reduc

tion in oxygen tension and retention of carbon dioxide regardless of whether air, helium, nitrous oxide or ethylene is used.

The data suggest that when a "wash-out" or the elimination of a gas (nitrogen, ether vapor, carbon dioxide) is

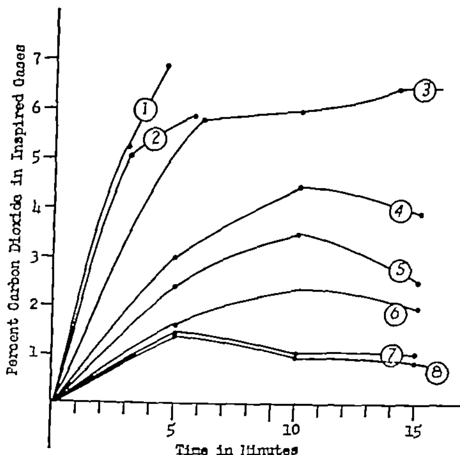


Fig. 118.—Carbon dioxide tension in inspired gases at lips when air was admitted into a Foregger single canister circle filter in use as semiclosed inhaler with absorber off. Figures in circles indicate flow of air in liters/minute. Similar patterns were obtained in studies of Heidbrink McKesson and to-and-fro inhalers. (Courtesy of Swartz, C. H., *et al.* Anesthesiology 14 437-448 September 1953.)

desired in units permitting rebreathing, the minute volume exchange must be delivered into the inhaler When no "wash-out" is desired and less than the minute volume exchange is delivered, an 80% gas and 20% oxygen mixture must be enriched with additional oxygen to avoid suboxygenation. Moreover the carbon dioxide absorber must be in operation to eliminate the possibility of carbon dioxide excess in these circumstances.

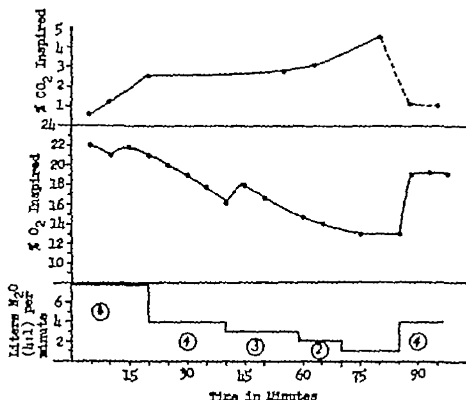


Fig 119—Parallel carbon dioxide and oxygen tensions during nitrous oxide anesthesia at varying rates of flow of 60-80% gas-oxygen mixtures with absorber off. Dotted lines indicate carbon dioxide absorber is on. (Courtesy of Swartz, O. H., *et al.* Anesthesiology 14 437-448 September 1953)

Concerning Concentration of Inhaled Gases in Semiclosed Anesthesia Systems Henning M. Ruben[7] (Copenhagen) points out that no conclusions concerning inhalation percentages can be drawn on *the basis of percentages of gas* flow from the machine The *maximal* percentage of gas a patient inhales when a certain percentage of gas is delivered from the machine at different total rates of flow can be calculated If

Ix = % of gas x in inhaled air
F = flow of gas x from machine in L./min.
E = % of gas x in exhaled air (expressed as decimal)
Fl = total flow of gas mixture from machine in L./min.
RMV = respiratory minute volume

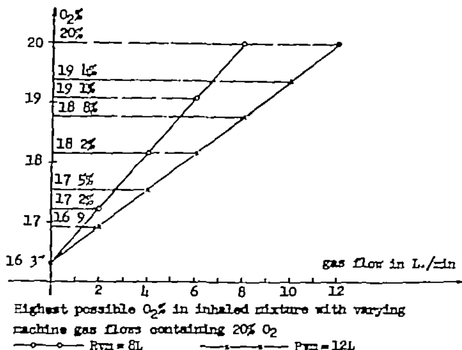
(7) Anesthesiology 14 459-465 September 1953

then it can be shown that

$$Ix \underset{<}{=} \frac{(F + [RMI - FI] \times E) \times 100}{RMI}$$

which is applicable for flows up to the respiratory volume/minute

For example, if the percentage of oxygen inhaled is calculated when different flows containing 20% of oxygen are delivered from the machine to patients with respiratory



Highest possible O_2% in inhaled mixture with varying machine gas flows containing 20% O_2
—o—o— Rvm = 8L —x—x— Pvm = 12L

Fig. 120 —(Courtesy of Raben, H. M. Anesthesiology 14 459-46 September 1953.)

minute volumes of 8 and 12 L. the results are those shown in Figure 120 If the flow containing the 20% of oxygen is kept constant at 2.5 L./minute, the curve in Figure 121 represents the effect of increasing respiratory minute volume on inhaled oxygen content Figure 122 shows the percentage of oxygen necessary in a 2 5 L. flow/minute to give 20% oxygen in the inhaled gas mixture at different respiratory minute volumes

None of these calculations takes into account the mechanical dead space which is usually of some importance especially when face masks are used.

Highest possible O_2% in inhaled mixture after 2 5 L gas flow containing 20% O_2 with varying Rvm.

Fig. 121 —(Courtesy of Ruben H M. Anesthesiology 14 459 465 September 1953)

O_2% necessary in 2 5 L flow per minute, which ideally gives 20% O_2 in inhaled gas mixture

Fig. 12 —(Courtesy of Ruben H. M. Anesthesiology 14 459 465 September 1953.)

Rebreathing in Pediatric Anesthesia Recommendations and Descriptions of Improvements in Apparatus. No entirely satisfactory apparatus is available for administering inhalation anesthetics by the closed system to infants and children When an infant is anesthetized with the standard apparatus used for adults, it is difficult to maintain an even plane of anesthesia As a rule, induction is prolonged and stormy and breathing is laborious and deep The exaggerated breathing suggests resistance to the passage of gases and hypercapnia. The latter is probably the result of excessive dead space, ineffective absorption of carbon dioxide or both. The difficulty in induction and maintenance suggests inadequate mixing of the gases and vapors This is most likely due to rebreathing from a dead space which approximates the tidal volume in size and also to a large total volume in the entire apparatus

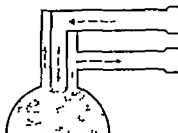


Fig 123—Modified connecting piece suggested for pediatric use. Center tube leads gases to flange of mask outer tube conducts them away Dead space is completely eliminated. (Courtesy of Adriani, J., and Griggs, T Anesthesiology 14:337-347 July 1953.)

John Adriani and Thomas Griggs[8] (Charity Hosp of Louisiana) have modified the circle filter apparatus to overcome these difficulties The foremost problem was elimination of dead space in the fittings This was done by eliminating the Y fitting and constructing a new obturator The fitting consists of two tubes, one inside the other (Fig 123) The size of the fitting is the same as that of the Y chimney piece, so that it will accommodate the standard size mask and endotracheal tubes.

To eliminate the dead space in the mask, a pump consisting of a rubber bulb (50 cc) with valves at either end was incorporated between mask and bag The bulb, which

(8) Anesthesiology 14 337 347 July 1953

permits a unidirectional flow of gases from the bag to the mask, merely circulates the gases, it does not exert pressure on the respiratory tract The bulb is manipulated manually as often as necessary

Two objections that had to be overcome in construction of the valves were "backlash" and resistance Valves were constructed by fastening a circular sheet of semirigid rubber in a hingelike manner on a brass bushing

The standard 5 L breathing bag is not satisfactory for pediatric use for two reasons (1) when dealing with low volume tidal exchange it is almost impossible to observe respiratory movements, and (2) the larger bags, because of the thickness of the rubber, are stiff and offer resistance to expiration. The authors substituted 500 cc thin latex bags with special adapters. For larger children, a 1,500 cc. bag is desirable

Rapid equalization of gas and vapor concentrations in the apparatus in order to expedite induction, lightening and deepening of anesthesia can be accomplished by rapid compression of the bulb introduced to wash gases from the mask. Clinical use of this apparatus has clearly demonstrated its value

---

MUSCLE RELAXANTS

Modifying Actions of Procaine on Myoneural Blocking Actions of Succinylcholine, Decamethonium and d-Tubocurarine in Dogs and Cats were studied by C H. Ellis, A. L Wnuck, E J De Beer and F F Foldes[9] (Pittsburgh)

Procaine, by interfering with the acetylcholine receptor mechanism, would be expected to increase the neuromuscular blockade caused by d tubocurarine and to decrease the paralyzing effect of decamethonium and succinylcholine The authors were able to confirm this assumption with regard to d tubocurarine However, the influence of procaine on the neuromuscular effects of succinylcholine and decamethonium was more complex. When procaine was given

(9) Am. J Physiol. 171 : 282 August, 1952.

before administration of decamethonium or succinylcholine, the intensity of the neuromuscular blockade was decreased. Only when it was injected after the relaxant drug could any augmentation of blockade be seen.

Since succinylcholine and decamethonium are "depolarizing" muscle relaxants, procaine, an antidepolarizing agent, would be expected to antagonize their neuromuscular effects. However, because procaine also interferes with hydrolysis of succinylcholine by the plasma cholinesterase, in certain circumstances it can increase the neuromuscular blockade caused by succinylcholine Which of the possible procaine effects will be dominant depends on several factors, including the plasma cholinesterase activity of the experimental animal and the sequence of administration of succinylcholine and procaine

Since competition for cholinesterase cannot account for the potentiation of decamethonium, it was postulated that procaine competes with acetylcholine released at the nerve endings for the true cholinesterase, causing a relative accumulation of acetylcholine In addition to its effect on plasma cholinesterase, procaine might also intensify the myoneural effect of succinylcholine by this second mechanism. There was some indication that the increase in intensity of paralysis produced by procaine might be less pronounced after decamethonium than after *succinylcholine*

An alternate hypothesis is presented to account for some of the intensifying effects of procaine, this involves an action on other parts of the central and peripheral nervous system The resulting depression, by interfering with facilitation of central tone or axonal conduction, might result in a state in which externally applied stimuli would not be summated with impulses of central origin and the nonsummated impulses would fail to excite the muscle fibers adequately There was no direct evidence to support this assumption, but the fact that the response is similar when procaine is given during recovery *from succinyl*choline, decamethonium or d tubocurarine suggests that some common factor exists

Role of Plasma Cholinesterase in Anesthesiology Francis

F Foldes and David H Rhodes, Jr[1] (Univ of Pittsburgh) point out that the role of cholinesterase is of great importance in the fate of the ester type local anesthetic agents and of the muscle relaxants in the organism

Generally, the potency of an ester type local anesthetic agent is related to its intravenous toxicity, and its subcutaneous toxicity is related to the rate of its enzymatic hydrolysis in plasma In patients with low plasma cholinesterase activity the toxicity of ester type local anesthetic agents can be much increased Patients with liver disease, malnutrition, anemia, cachexia and dehydration, as well as patients with accidental intoxication (insecticides) or deliberate poisoning (war gases) with anticholinesterase agents, belong to this group Local anesthetic agents should be used with extreme care in such patients. The agent of choice should be one that is hydrolyzed most rapidly, its concentration and volume should be kept to the minimum, and systemic absorption should be decreased by the addition of vasopressors 2 Chloroprocaine is the agent of choice

Succinylcholine is hydrolyzed rapidly by the plasma cholinesterase Consequently, after the development of a distribution equilibrium between plasma and neuromuscular units, after the intravenous administration of a single dose, the duration of neuromuscular blockade will depend primarily on the hydrolysis rate of succinylcholine in plasma Similarly on continuous intravenous administration the intensity of neuromuscular blockade will be determined by a balance between the quantity of succinylcholine administered and the quantity hydrolyzed per unit of time

Patients with low plasma cholinesterase activity require lower doses of succinylcholine for production and maintenance of muscular relaxation This need for lower dosage can be recognized early in the course of anesthesia. Consequently after cessation of succinylcholine administration, the time required for the return of normal neuromuscular conduction will not differ greatly from that in patients with normal plasma cholinesterase activity

Another consideration of practical clinical importance

(1) Anesth. & Analg. 32 30?-318 Sept.-Oct., 1953

is the simultaneous use of succinylcholine and ester type local anesthetic agents in patients Substrate competition between the two compounds for plasma cholinesterase will develop, thereby augmenting the pharmacologic effects of both compounds Comparable degrees of muscular relaxation can be maintained by the administration of smaller milligram/minute doses of succinylcholine

Resistance to d Tubocurarine Chloride in Presence of Liver Damage J W Dundee and T Cecil Gray[2] (Univ of Liverpool) report observations which confirm the clinical

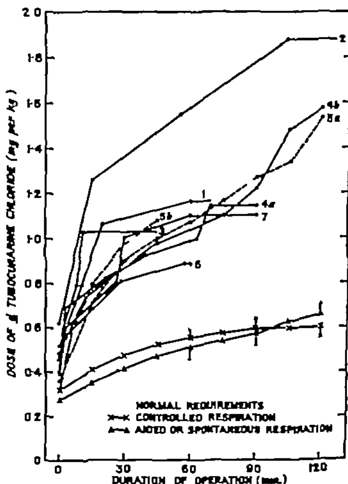


Fig 124 —Individual requirements of d-tubocurarine chloride for nine administrations to 7 subjects with liver dysfunction also average requirements of 200 normal subjects (100 with controlled and 100 with aided or spontaneous respiration) Vertical lines indicate variation in normal response (2 × S.E. of mean) (Courtesy of Dundee J W., and Gray T C.: Lancet 2 16 17 July 4 1953)

(2) Lancet 2 16 17 July 4 1953

impression that patients with liver damage have an increased resistance to true curare-like drugs. The requirements of d-tubocurarine chloride of 200 patients undergoing abdominal operations were compared with those of 7 patients with evidence of liver damage who were having similar operations. Results are shown in Figure 124.

Further proof that liver damage increases the resistance to d-tubocurarine was provided by a patient who had two anesthetics given by identical technics. On the first occasion a marked degree of liver dysfunction was present and she showed considerable resistance to d-tubocurarine. At the second operation liver function was improved and tolerance to relaxant drugs was within the range of normal.

Patients with liver damage have a lowered serum pseudocholinesterase. It has been demonstrated that administration of drugs such as hexaethyltetraphosphate, which reduce pseudocholinesterase and leave red cell cholinesterase unaffected, increases response to a subsequent injection of acetylcholine. The authors suggest that in patients with lowered pseudocholinesterase there is an excess of, or an increased sensitivity to acetylcholine at the end plate. This might account for the resistance to d-tubocurarine chloride shown by patients with liver damage.

Intestinal Blood Flow in Curarization. Leonard H. Elwell and John W. Bean[3] (Univ. of Michigan) observed that intra-arterial administration of d-tubocurarine to innervated and denervated perfused segments of dog intestine increased blood flow through the segments as determined by thermopile and drop methods and decreased intestinal tonus and rhythmic contractions. The increased blood flow was ascribed to a dilating action on the intestinal vasculature rather than to any attendant reduction of tonus of the intestinal wall or its contractile activity. This was shown by well pronounced augmentations of flow evoked by d-tubocurarine after atropinization which, while inhibiting tonic and contractile activity, caused only a relatively minor increase in blood flow by itself.

The authors' data show that d-tubocurarine augments blood flow through the intestine essentially the same as it

(3) Am. J. Physiol. 175:185-190, July, 1953.

has been found to do in striated muscle. In contrast to this similarity of action of tubocurarine on the blood vessels of these tissues, the effects on the contractile mechanisms of intestinal and striated muscles are quite different, in intestinal muscle it reduces both tonic and rhythmic contractions, whereas in striated muscle it enhances tonus and augments contractions.

These experiments demonstrate that the splanchnic vasculature contributes significantly to the generalized circulatory response to curarization.

INFILTRATION AND REGIONAL ANESTHESIA

Penetrance of Local Anesthetics. In clinical and experimental anesthesia the speed of induction with a given local anesthetic depends on (1) local anesthetic activity, (2) dose (volume and concentration of the solution injected), (3) distance from the site of application to the site of action, (4) penetrability of the tissues between those two sites and (5) the penetrance of the compound, i.e., its inherent ability to penetrate those tissues. Theodore G. Brown, Jr., and F. P. Luduena[4] (Rensselaer, N. Y.) studied the penetrance of five local anesthetic compounds in the sciatic nerve of the cat in vivo, using the drugs in equiactive concentrations, i.e. concentrations in inverse ratio to their local anesthetic activity.

In equiactive concentrations procaine, lidocaine and ravocaine® had essentially the same rates of penetration. Dibucaine was the least penetrant and WIN 3766 the most penetrant of the five compounds tested. These results indicate that penetrance is not related to activity. Dibucaine and WIN 3766 were the most active compounds tested and the activity of the other three differed from 1 (procaine) to 11 (ravocaine®).

An unexpected finding was the lack of correlation between the speed of penetration and the recovery time. The order of recovery was procaine $>$ lidocaine $>$ ravocaine®

---

(4) Anesthesiology 14 555-560 November 1953

> WIN 3766 > dibucaine It was noted that if dibucaine were omitted and the other compounds considered as a group, all of these being much less irritating than dibucaine, the weaker the compound the shorter the recovery period The authors suggest that local destruction of the anesthetics may play a part in decreasing their concentration to subthreshold values Dibucaine is not destroyed by pseudocholinesterase procaine, on the other hand, is so hydrolyzed The effect of pseudocholinesterase on ravocaine[2] and WIN 3766 is not known.

Accurate Identification of Colorless Solutions to Prevent Chemical Sloughs is urged by Kenneth Pickrell, Frank Masters, Nicholas Georgiade and Charles Horton[5] (Duke Univ) Reactions to local anesthetic agents are of three types those dependent on true hypersensitivity to the drug those resulting from absorption of a toxic dose and those due to administration of the wrong solution

Solutions which may be mistaken for procaine have in common their lack of color and their frequent use not only in the operating room but throughout the hospital. They fall into three groups (1) such necrotizing solutions as alcohol, ether boric acid, phenol and Formalin, all of which will induce anesthesia but lead to necrosis of tissue (Figs 125 and 126) (2) such biologically potent preparations as epinephrine and cocaine hydrochloride atropine sulfate and morphine sulfate all of which may cause death if administered in sufficient quantity and (3) less potent solutions like distilled water hydrogen peroxide concentrated glucose and sodium lactate which may also cause severe reactions.

Substitution accidents may occur in several ways the commonest of which appears to be error by the nurse house officer or surgeon who with several colorless solutions on the instrument tray may draw the wrong solution into the syringe

Since procaine can be tinted a distinctive and characteristic vivid pink red by addition of Ponceau SX dye the authors advocate this method of identification over all other methods because it permits ready identification in the syr

(5) Plast & Reconstruct. Surg 1 *11 19 September 1952

inge before and during injection Repeated autoclaving does not destroy or change the color, filtration does not remove the dye and it does not tattoo the skin, subcutaneous tissues or conjunctivas It readily washes out of linens and clothing

The authors further describe and recommend (1) a procaine test paper which will identify colorless or tinted pro-



Fig 125 (left) —An unknown preparation had been injected into maxillary area before removal of small cutaneous lesion under local anesthesia. Within 48 hours an extensive hemorrhagic slough had developed.

Fig 126 (right) —Infant had been given "fluid" into veins of scalp to combat dehydration due to dysentery Within 24 hours, demarcation of an area of impending slough was reported to have been apparent. Photo taken approximately 10 days later

(Courtesy of Pickrell K. *et al*: Plast. & Reconstruct. Surg 12 211 219 September 1952)

caine and distinguish it from pontocaine,* (2) tinting of alcohol a vivid fluorescent green by addition of fluorescein and potassium carbonate, (3) tinting of ether yellow by addition of p-dimethylaminoazobenzene (4) tinting of boric acid lavender by addition of amaranth and brilliant blue (although they question the antiseptic value of boric acid and the advisability of its use), (5) use of phenol red indicator dye in solutions of sodium lactate to identify it and to indicate its pH and (6) the addition of indigo carmine

to mercury bichloride solutions, although they stress that its dangers far exceed its virtues and question the advisability of its use

Saphenous Vein Stripping under Femoral Nerve Block Anesthesia. The anterior femoral cutaneous and the saphenous nerves are the sensory branches of the femoral nerve carrying the major innervation of the tissues overlying the distribution of the saphenous vein The femoral nerve enters the thigh by emerging beneath the inguinal ligament at a point 1 1.5 cm. lateral to the femoral artery in the femoral sheath. It lies in the groove between the iliacus and psoas major muscles and almost immediately divides into its terminal branches

It has been found that subcutaneous infiltration of a local anesthetic agent below the inguinal ligament with concomitant femoral nerve block at this level gives adequate anesthesia for ligation and stripping of the greater saphenous vein Victor Baum and Murry G Fischer[6] (New York Polyclinic Med School) stripped 25 extremities of varicosities, using the following procedure

TECHNIC.—All patients had premedication with a barbiturate. Procaine 1% was used for local infiltration and procaine 2% for femoral nerve block. Epinephrine in 1 100 000 concentration was used with procaine except when medically contraindicated. The skin and subcutaneous tissue were infiltrated over the fossa ovalis. Deeper subcutaneous infiltration should extend to the inguinal ligament medially and laterally Three cc. of solution was deposited below the fascia. High ligation was then performed. The femoral vein should be well exposed at the fossa and the artery palpated lateral to it With the index finger on the artery as a guide the needle was directed either percutaneously or directly through the subcutaneous tissue to the region 1 1.5 cm. lateral to the artery and cephalad under the inguinal ligament. By probing with the needle in this area, an attempt was made to elicit paresthesia. When this was accomplished 5-10 cc. of solution was deposited at this point. If paresthesia could not be elicited, the same area was flooded with 10-20 cc. of solution in fanlike fashion. The patient was then tested for cutaneous sensitivity at various levels along the saphenous vein It may be 5-10 minutes before anesthesia is complete, therefore this infiltration should be done before high ligation is completed The vein may now be stripped down to the medial malleolus in the usual fashion. Occasionally supplemental local infiltration must be

(6) New York J Med. 54 533 535 Feb 15 1954

therefore, that at least part of the block of peridural anesthesia must occur within the subarachnoid space The exact mechanism whereby procaine penetrates the dural barrier is unknown

Transference of these interpretations to clinical spinal and peridural anesthesia is limited by the fact that in these studies only threshold concentrations of the drug were administered and minimal sensory blocks were produced The occurrence of motor paralysis during conventional spinal anesthesia when greater drug concentrations are created must mean that either the ventral roots or the cord are blocked with these higher concentrations.

Concentration of Pontocaine® Hydrochloride in Cerebrospinal Fluid during Spinal Anesthesia, and Influence of Epinephrine in Prolonging Sensory Anesthetic Effect were studied by J Gerard Converse, C M. Landmesser (Albany Med. College) and M. H. Harmel[8] (State Univ of New York, Brooklyn)

METHOD—In each of 15 patients, a Tuohy spinal catheter was introduced through the 2d lumbar interspace and up the spinal canal for a distance of 5 cm., so that the tip rested approximately at the level of the 12th thoracic vertebra. Then a 24 gauge spinal needle was introduced through the 3d lumbar interspace for administration of the spinal anesthetic. Each of nine patients received 16 mg of 1% pontocaine® mixed with 2 4 cc. of 10% dextrose, and each of six patients received 14 mg of 1% pontocaine® mixed with 2.1 cc. of 10% dextrose plus 0.5 cc. of 1 1,000 epinephrine. Cerebrospinal fluid samples, including an initial control before injection of the anesthetic, were collected from the Tuohy catheter 5 10, 15, 30, 60, 90 and 120 minutes after the intrathecal injection of the spinal anesthetic mixture.

In the patients who received the pontocaine®-dextrose mixture with epinephrine, the pontocaine® concentration in the cerebrospinal fluid was substantially greater after the first five minutes than in those who received the pontocaine® dextrose mixture without epinephrine this despite the fact that the dose of pontocaine® originally injected was less in the former than in the latter group of patients.

Although epinephrine added to the anesthetic mixture injected intrathecally delayed the disappearance of pontocaine® from the cerebrospinal fluid during the initial phase

(8) Anesthesiology 15 1 10 January 1954

of spinal anesthesia it did not prevent the pontocaine® concentration in the cerebrospinal fluid from falling subsequently to the same level during anesthesia as when the pontocaine®-dextrose mixture was given without epinephrine Despite similar values for pontocaine® concentration in cerebrospinal fluid noted in both groups after 90 minutes, sensory anesthesia to pinprick persisted at higher levels for longer times in the group receiving pontocaine® and dextrose with epinephrine

It would appear that the effectiveness of sympathomimetic amines in prolonging the duration of spinal anesthesia results from their ability to limit vascular absorption of the anesthetic agent in the first few minutes after injection, and from the consequent immediate high concentration of local anesthetic bathing the spinal nerve roots as they cross the subarachoid space The authors suggest that the duration of spinal anesthesia is a function of the initial cerebral spinal level of local anesthetics rather than a function of so-called critical level after 30-60 minutes

In an attempt to substantiate this hypothesis, three additional patients were studied. At 30 minutes after the initial intrathecal injection of the same dose of pontocaine®-dextrose-epinephrine as used in the earlier studies, the intrathecal space of each patient was flushed with 40 cc normal saline solution. Pontocaine® concentrations in cerebrospinal fluid following dilution and flushing at the end of 30 minutes were of the same magnitude as those observed at the end of 90 minutes in the "unflushed" patients Despite this extremely low pontocaine® concentration sensory anesthesia to the 3d thoracic segment (the level at the onset of anesthesia) persisted for at least an additional 105 minutes, the period of observation

Neurologic Effects Following Intrathecal Administration of Vasoconstrictor Drugs in Rhesus Monkeys The vasoconstrictor drugs used in this study by Jone J Wu, Dann Lee A. Harnagel, Kenneth R Brizzee and Scott M. Smith[9] (Univ of Utah) were epinephrine ephedrine and neosynephrine® The doses were 10 to several hundred times the clinical dose

(9) Anesthesiology 15 71 88 January 1954

Following small doses of epinephrine, excitation developed which was characterized by hyperextension, rigidity and hyper reactive tendon reflexes Larger doses produced excitation followed by depression. The latter was characterized by dulled sensory perception and paresis With a further increase in dosage, excitation was reduced in duration but not in intensity and the depression became more profound The clinical picture and neurologic signs were similar to those of acute anoxia or hypoxia of the spinal cord

Intrathecal injection of ephedrine produced spinal anesthesia which did not differ from that produced by common spinal anesthetic agents A dose of 30 mg /kg of a 5% solution produced spinal anesthesia for four hours or more Recovery from this dosage was complete although some muscular weakness persisted for a few days No distinct excitation was noticed after injection except a slightly hyperactive knee jerk The clinical picture and neurologic signs were different from those described following acute anoxia of the spinal cord and therefore vasoconstriction was considered to be an unimportant factor in this connection

Intrathecal injection of small doses of neo-synephrine* resulted in slight muscular weakness of short duration. Larger doses resulted in tremors hyper reactive knee jerks and general depression The duration and intensity of general depression were further increased in proportion to the concentration and dose A dose of 15 mg /kg in 2.5% solution produced spinal anesthesia which, however was different from that produced by the common spinal anesthetic agents in that there was not complete motor paralysis A dose of 30 mg /kg in 5% solution produced profound spinal anesthesia without complete recovery The authors feel that these symptoms are the result of a toxic action of the drug in the nerve tissues

Systemic changes in blood pressure and heart rate following the intrathecal injection of all three of these vasoconstrictors were almost always detectable Since the doses used in this study were large, it is highly probable that a considerable concentration may have reached the venous

blood through the thoracic lymph channel and produced the systemic changes

Studies of Hemodynamic Changes in Humans Following Induction of Spinal Anesthesia IV Observations in Low Spinal Anesthesia during Surgery were recorded by Salvatore M Sancetta R B Lynn, F A. Simeone, Gladys Heckman and Hanna Janouskovec[1] (Western Reserve Univ), the data on six patients are given in Tables 1 and 2 The results and changes compare with those seen in patients studied during spinal anesthesia under laboratory conditions eliminating the anxiety over expected surgery

Also discussed are the dangers arising from changes due to inadequate anesthetic levels in the waking surgical patient—the great increase (nearly double in one case) in heart rate and cardiac output and the serious decrease in oxygen saturation (from 93 1 to 84% in the same case)

Of two types of hypotension discussed and differentiated, the first is termed "simple spinal anesthetic hypotension" and is due to spinal sympathetic blockade It is characterized by warm, pink skin, well maintained peripheral blood flow unaltered oxygen saturation, only slightly and temporarily increased heart rate decreased splanchnic and coronary bed blood flow unchanged cerebral bed blood flow in normotensive subjects, but probably adequate since no lasting damage to vital organs can be demonstrated Although vasopressor drugs given parenterally will rapidly raise blood pressure, there is no evidence that such elevation is necessary or even desirable as it can mask the subsequent insidious decrease in blood pressure that somehow appears to be related to gradual blood loss and visceral manipulation If the use of a vasopressor drug is regarded essential nor epinephrine which is least likely to increase heart rate would be the drug of choice

The second type of hypotension, termed 'hypotension of unknown cause" by the authors is not due to hemorrhage or visceral manipulation, but appears abruptly and dramatically some time after the anesthetic level and blood pressure appear to have become stabilized It is more common in the aged and in persons with large vessel sclerosis and

---

(1) Surg., Gynec. & Obst. 9 55 -60 November 19 3

TABLE 1.—HEMODYNAMIC AND BLOOD OXYGEN CHANGES INDUCED BY LOW SPINAL ANESTHESIA (MEAN PRESSURES IN PARENTHESES)

Patient		L.H.	R.T.	R.W.	D.B.	L.O.	E.C.	Average	Percentile change
Age and sex		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
Operation		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—
Anesthetic and level, mgm.		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—
Brachial arterial pressure (mm. Hg)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Right atrial pressure (mm. Hg)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Pulmonary arterial pressure (mm. Hg)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Finger blood flow (c.c./100 c. part/min.)	Control	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Cardiac output (c.c./min.)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Stroke volume (c.c./stroke)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Pulse rate (/min.)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Oxygen consumption (c.c./min.)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Oxygen capacity (Vol. per cent)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Brachial art. O_2 content (Vol. per cent)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Pulm. art. O_2 content (Vol. per cent)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
A-V oxygen difference (Vol. per cent)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]
Arterial O_2 saturation (Per cent)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]

systolic hypertension The skin turns cold and may become livid, brachial arterial blood shows no significant decrease in oxygen saturation, yet cyanosis of mucous membranes and nail beds (stagnant anoxia) may be present In this type of hypotension vasopressor drugs fail to produce the

TABLE 2.—Cardiac Indexes, Left Ventricle Work and Total Peripheral Resistance

Patient		L.H.	R.T.	R.W.	D.B.	L.Q.	R.C.	Average	Percentile change
Cardiac index (L./sq.m./min.)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Left ventricular work (Kg.M./minute)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total peripheral resistance (Absolute units)	Control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	30 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	60 min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Index not calculable (old amputation, left leg)

dramatic increase in blood pressure noted in "simple spinal anesthetic hypotension," and blood transfusion is the one single most effective measure

Role of Intrathecal Detergents in Pathogenesis of Adhesive Arachnoiditis Though there are numerous reports of arachnoiditis following spinal anesthesia, only seven histologically verified cases of adhesive arachnoiditis are reported in the literature Richard M Paddison and Bernard J Alpers[2] (Jefferson Med. College) report a case that differs from the others in that the entire neuraxis was involved in a progressive process with onset 24-48 hours after spinal anesthesia

Man, 54, had tetracaine spinal anesthesia for the performance of cholecystectomy In the immediate postoperative period, bladder dysfunction, radicular pain and an organic mental syndrome developed Neurologic examination revealed apathy, an organic mental syndrome, sphincteric incontinence, small sluggish pupils and overactive but equal deep reflexes. Cerebrospinal fluid obtained from the cisterna magna contained 14 cells/cu mm., with negative Wassermann reaction and normal colloidal gold curve. Ventriculography revealed symmetrical massive dilatation of the entire ventricular system. He died 24 hours after this procedure, and 63 days after spinal anesthesia

It was felt that a detergent, Alconox, used in preparation of the equipment was inadvertently introduced intrathecally during the anesthesia It is possible that this substance, owing either to its inherent biologic activity or to its synergistic activity with the anesthetic agent, produced severe damage to the neural structures

(2) A.M.A. Arch. Neurol. & Psychiat. 71 87 100 January 1954

That detergent compounds have a profound biologic activity has been shown by many workers Loeb found that surface active agents, when applied to the unfertilized sea urchin egg, produced cleavage and development, higher concentrations caused cytolysis Leopold concluded that detergents in high concentrations are potentially toxic to external ocular structures. Reiner found that the anionic surface active compounds are potent agents in the production of venous thrombosis Hodges reported that Alconox used in the preparation of hematologic laboratory glassware left a residual film with sufficient activity to nullify the validity of fragility tests, owing to increased hemolysis of normal erythrocytes by the residual detergent

Detergent materials probably should not be employed in the preparation of apparatus used in mixing and injecting spinal anesthetic agents

---

HYPOTHERMIA

Action of Chlorpromazine (Largactil) on Tissue Respiration (Consumption in Oxygen) Pharmacologic block of the autonomic nervous system reduces basal metabolism and allows reduction of the homeostatic defenses of the organism It permits the further lowering of oxygen consumption by means of general refrigeration By diminishing the oxygen requirements tissue anoxia, a principal factor in shock, is avoided.

L Peruzzo and R B Forni[3] studied the oxygen consumption in slices of liver brain and kidneys of 21 rats, using the Warburg manometer technic Through the manometer Ringer phosphate solution of largactil (chlorhydrate di chloro-3[dimethylamino-3 propyl] 10-phenothiazine) was added in progressively increasing doses to the tissues Oxygen consumption in the brain tissue decreased after 50 minutes but remained unchanged in the liver and kidney tissues.

Larger doses of largactil were injected intraperitoneally

(3) Presse méd 61 1463 Nov 11 1953

into a second group of rats Rectal temperatures of the animals decreased to 30 C after 80 minutes and all rats were killed The liver, brain and kidneys were dissected and small pieces placed in the Ringer phosphate solution for manometric studies Controls were given intraperitoneal injections of physiologic saline The brain tissue of the largactil treated rats consumed 57% oxygen less than that of the controls The authors consider the action of largactil to be reversible

Cerebral Effects of Experimental Hypothermia in immature monkeys were studied by John C Callaghan Donald

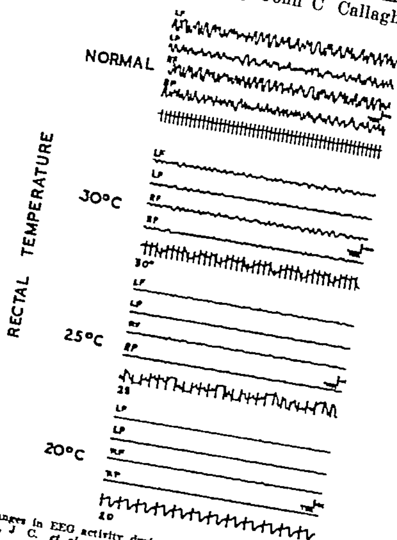


Fig 128 —Changes in EEG activity during reduction of body temperature (Courtesy of Callaghan, J C et al A.M.A. Arch. Surg 68 208 214 February 1954)

A. McQueen, John W Scott and W G Bigelow[4] (Univ of Toronto) Survival rate, electroencephalographic changes, behavior test performance, reflexes and changes in cardiovascular and respiratory control were selected as factors in the assessment of cerebral function.

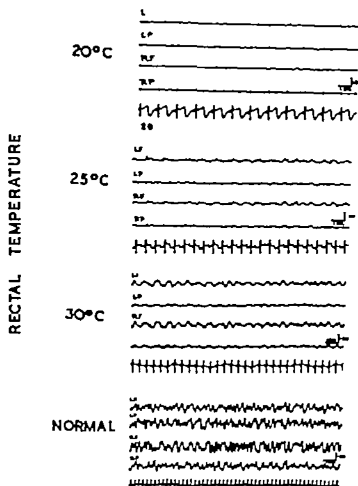


Fig. 120 —Changes in EEG activity during rewarming. (Courtesy of Callaghan J C., et al. A.M.A. Arch. Surg. 68 208-214 February 1954)

All 10 animals studied survived the lowering of the body temperature to 20 C or less, and at no time during the cooling process did their condition cause special concern Slowing of the heart and respiratory rates together with deep unconsciousness was noted as cooling progressed.

Electroencephalographic studies disclosed a depression

(4) A.M.A. Arch. Surg 68 208 214 February 1954

of cortical activity during cooling (Fig 128), with little or no activity at 20 C The rhythms returned in reverse order on rewarming (Fig 129) There was no evidence of cerebral damage

Cooling to 20 C had no effect on the aptitude with which the animals subsequently performed tests learned before the experiment

Coronary Blood Flow and Myocardial Metabolism in Hypothermia. Observations of coronary blood flow and myocardial metabolism were made on dogs before and after immersion hypothermia by W Sterling Edwards S Tuluy,

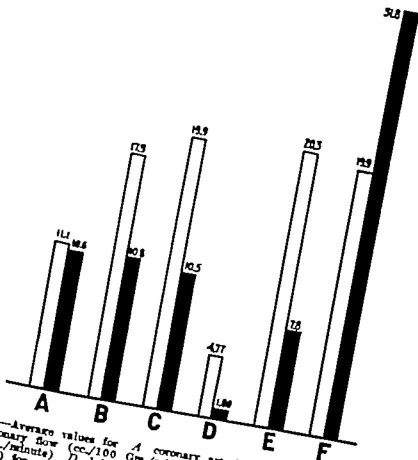


Fig 130.—Average values for *A* coronary arteriovenous oxygen difference (vol. %) *B* coronary flow (cc./100 Gm./minute) *C* myocardial oxygen consumption (cc./100 Gm./minute) *D* left ventricular work (kg m.) and *E* left ventricular efficiency (%) for normothermic (white columns) and hypothermic (black columns) states. Column *F* compares percentage of total oxygen consumption used by heart in normothermia and hypothermia. (Courtesy of Edwards, W S., *et al*: Ann. Surg 139 5 80 March, 1954)

W E Reber, A. Siegel and R J Bing[5] (Med College of Alabama) Although coronary arteriovenous oxygen difference remained unchanged from the normothermic state coronary blood flow and myocardial oxygen consumption decreased (Fig 130) Aerobic energy uptake and left ventricular work both declined, but the proportionally greater fall in ventricular work suggested failure of mechanical efficiency of the heart in the cold state

Hypothermia does not result in a discrepancy between myocardial oxygen demand and supply, as occurs in myocardial anoxia resulting from deficiencies of coronary blood supply It is probable that in hypothermia the oxidative enzymatic processes are slowed resulting in decreased demands of the myocardium for oxygen

Acid Base Balance of Blood in Dogs at Reduced Body Temperature was studied by Ross Fleming[6] (Univ of Toronto) The pH of 10 dogs studied showed an average drop of 0 016 units/degree centigrade drop Plasma carbon dioxide content rose from an average of 22 mEq /L at normal body temperature to 30 mEq /L at 20 C The P_{CO_2} rose from 45 to 130 mm Hg This change was due to two factors diminished respiration and increased solubility of carbon dioxide in blood at lowered body temperature There was little significant change in any of the other cations measured namely, chlorides, inorganic phosphorus and lactic acid level ketone bodies were not found Likewise there was no significant change in the concentration of sodium, potassium, calcium and magnesium

Figure 131 summarizes the changes in the acid base pattern in the blood It is obvious that this is an uncompensated acidosis mainly gaseous in origin

Fleming found that although administration of base during cooling tempered the acidosis so that the average drop in pH was only 0 009 units/degree centigrade the mortality rate and frequency of cardiac irregularities was not altered significantly

When positive pressure artificial respiration with oxygen was given from the moment the dog was anesthetized, the

(5) Ann Surg 139 275 280 March, 1954
(6) A.M A. Arch. Surg 68 145-152 February 1954

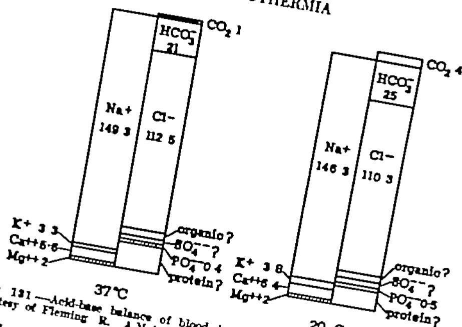


Fig 131 —Acid-base balance of blood in routine hypothermia at 37 and 20 C. (Courtesy of Fleming R. A.M.A. Arch. Surg 68 145 152 February 1954)

blood pH could be kept constant or made to rise, with a simultaneous decrease in plasma carbon dioxide Two thirds of the dogs so treated survived as compared with one third of those dogs allowed to become acidotic

Cessation of Circulation in General Hypothermia II Anesthetic Management More than 100 dogs were used in the laboratory by Irvin Zeavin, Robert W Virtue and Henry Swan (Univ of Colorado) before optimal conditions for hypothermia and avoidance of circulatory arrest were obtained Continuous hyperventilation was of extreme importance accumulation of carbon dioxide greatly increased incidence of ventricular fibrillation The animals were cooled by immersion in ice water The electric defibrillator was of no value in the cold dog Therefore to defibrillate the heart, potassium chloride was injected into the aorta proximal to an occluding clamp The heart was massaged against the clamp to force the potassium into the coronary arterial system to produce cardiac standstill The clamp was then removed and the heart massaged If tone did not return soon, the procedure was repeated using calcium chloride This brought tone back to the heart and started regular ventricular rhythm

( ) Anesthesiology 15 113 121 March 1954

Results of Hypothermic Anesthesia in 11 Patients

Case	Age, years	Weight, pounds	Premedication		Pentothal, mg.	Cooling Period, minutes	Temp. when Removed from Ice, °C.	Lowest Temp., °C.	Skin-to-Skin, minutes	Time of Occlusion, min. sec.	Time in Warm Water min.	Operation	Temp. when Removed from Water °C.
			Morphine, mg.	Atropine, mg.									
1	11	74	10	0.4	125	37	34	28.0	96	None	55	Pulmonary Valvulotomy	33
2	8	63	8	0.3	175	44	29	25.2	85	7'30"	33	Pulmonary Valvulectomy	34
3	7	51	7	0.3	125	37	30	23.6	118	2'00"	31	Pulmonary Valvulectomy	33
4	8	66	8	0.3	125	39	30	25.7	90	3'06"	30	Pulmonary Valvulectomy	32
5	9	66	8	0.3	150	35	30.8	23.7	79	2'25"	45	Pulmonary Valvulectomy	33
6	26	104	10	0.4	180	77	29	22.3	77	7'30"	90	Close Interatrial Septal Defect	33
7	10	70	10	0.4	0	45	31	24.6	105	8'25"	30	Pulmonary Infundibulotomy	33
8*	6	41	5	0.3	75	40	29	22.4	105	5'30"	45	Close Interatrial Defect	32
9	52	140	15	0.4†	135‡	43	31.7	30.0§	390	None	70	Left Hepatectomy	32
10	11	60	3	0.3	150	35	31	26.0	230	None	0	Anastomosis Aorta to Pulmonary Artery	32
11	3	34	3	0.2	0	23	30	25.5	108	2'10"	75	Pulmonary Valvulotomy	37

* Fibrillation at 27.5 C. before operation began.
† Scopolamine.
‡ Secobarbital sodium.
§ Maintained at 30 C. for 5½ hours.

Hypothermic anesthesia was used in 11 patients All recovered satisfactorily (see table) Each patient was lightly anesthetized by cyclopropane, then carried to lower second plane of anesthesia with ether before immersion in ice water At about 29 C spontaneous respiratory efforts usually ceased Thereafter, hyperventilation with oxygen was used In two cases curare was given to produce relaxation during surgery As the temperature began to rise, the patients frequently began to move, therefore closures were completed under 1 1 nitrous oxide oxygen.

Ventricular fibrillation occurred in one case some time between removal from ice and the moment the ECG was connected on the operating table Cardiac massage plus potassium chloride and later calcium chloride restored normal rhythm. The patient then underwent five minutes of circulatory arrest and closure of an interarterial septal defect under direct vision without difficulty

The hypotension achieved with hypothermia is physiologic in that it is accompanied by a reduced oxygen demand of the organism.

Hypothermic anesthesia is indicated (1) only when the operating room team is prepared to recognize instantly and cope with cardiac standstill or ventricular fibrillation of the cold heart, (2) when occlusion of the entire circulation is required to perform intracardiac surgery, (3) when hypotension is desired in poor risk patients, (4) for cyanotic patients whose oxygen demand should be reduced, and (5) when regional occlusion of the circulation is desired for prolonged periods

Intravenous Procaine in Treatment of Chest Wall Injuries was administered by P Gilroy Bevan[8] (Birmingham) to reduce pain and muscular spasm and thus improve respiration The standard dose for a normal adult was 20 ml of 1% procaine solution injected during not less than five minutes Precautions are required against convulsions or peripheral vascular failure However, these were not seen after any of the 82 procaine injections given Three patients lost consciousness and two lost the power of speech, these effects were transient In two elderly men the pulse was irregular for an hour

Pain was greatly or moderately relieved in most patients, and respiratory function and general condition improved Relief was greater in patients with fractures than in those with soft tissue injuries. Benefit was greatest when the injection was given soon after injury In some cases relief was immediate in others it was delayed for a few hours It lasted an average of 20 hours A second injection was never as effective as the first

Estimation of procaine levels in blood and urine after an injection confirmed previous observations that procaine is excreted from the blood within an hour Its effect over a period of hours or days is probably due to a breaking of the vicious circle—pain muscle spasm pain

In a small series of controls, intravenous injections of physiologic saline were given under similar conditions Some benefit was evident but it was much less than with procaine, and it was not greater with fractures than with soft tissue injuries.

Body Temperature Studies in Anesthetized Man Effect of Environmental Temperature, Humidity and Anesthesia System in 164 adults undergoing lengthy operations was studied by Robert E Clark, Louis R Orkin and E A Rovenstine[9] (New York Univ) The temperature in the air

(8) Lancet 1332 1334 Dec 26 1953
(9) J.A M A 154 311 319 Jan. 23 1954

way and in various locations in the to and fro, circle and non rebreathing anesthetic systems were recorded The dry bulb temperature under the surgical drapes was measured over a 20 F room temperature range

Wet bulb temperature is the most satisfactory measure of thermal tolerability of an environment Below 75 F wet bulb temperature heat retention is uncommon in adults who are afebrile before operation Above this temperature body temperature rises progressively sometimes conspicuously, regardless of the anesthesia system used

Below 75 F wet bulb temperature height and rate of body temperature rise is slightly but consistently greater in patients anesthetized with the to-and fro system than with the circle and non rebreathing systems Above this temperature heat retention is most frequent when the to and fro system is used With this type of system, evaporation from the lung cannot occur because the temperature throughout the system is hotter than the exhaled gases

Heat retention in surgical patients can be prevented If air conditioning is not available it is advisable to postpone elective surgical procedures when the wet bulb temperature of the operating room is 75 F or above Light draping is urged during warm weather and use of the to-and fro anesthesia system should be avoided If it is used the canister should be cooled with ice Small doses of belladonna premedicant drugs are advisable since they decrease sweating Patients should be brought to the operating room adequately hydrated and with any salt depletion corrected fluid lost during surgery should be carefully replaced Frequent measurements of the patient s body temperature should be made (the posterior nasal temperature is convenient to measure and is satisfactory) in order to permit prompt recognition of heat retention. Cessation of sweating should be regarded as an urgent danger signal

Under operating room conditions, the most effective methods of treating pyrexia are those that utilize conduction—the water-cooled mattress and ice bags The preferred locations for ice bags, insofar as surgery permits are between the thighs in the inguinal regions axillae, flanks and chest The water-cooled mattress is most convenient and effective

both prophylactically and in treatment Other effectual co tributory methods of treating heat retention include ligl ening of the surgical drape and promotion of air curren under the drapes

Cortisone Problems Involving Anesthesia. One aspect endocrine disturbance resulting from use of cortisone a corticotropin is depression of adrenal cortical function Jol S Lundy[1] (Mayo Clinic) points out that as use of the agents becomes more widespread, the anesthesiologist w encounter patients who previously have been treated wi them. If, during anesthesia and operation on such a patie unexplained shock develops and if response to the usu treatment is unsatisfactory, the possibility of unrecogniz depressed adrenal cortical function must be considered a proper therapy immediately instituted

Circulatory collapse in patients who at some time pr vious to operation have been treated with one of these ho mones but who have not received it preoperatively and/ during and after operation is characterized by sudden a extreme onset at the time of operation or up to 24-36 hou postoperatively These patients can be supported tempora ily by use of solutions of "plasma volume expanders" co taining a small quantity of levophed,* ephedrine or ne synephrine * These measures, however are of tempora value Cortisone is essential to life and must be provide If possible treatment should be prophylactic

A suggested schedule for preparing for anesthesia a operation on patients with a suppression of adrenal cortic function consists of intramuscular administration of 10 200 mg cortisone daily for two to three days before oper tion, on the day of operation and for the same length time postoperatively After that, the dose should be gra ually reduced until it reaches the previous optimal figur

In an emergency, 30-50 cc adrenocortical extract injecte intravenously and repeated as needed, in addition to r sumption of the use of cortisone or corticotropin can b employed to maintain the unprepared patient safely durin the period of stress, so that he may be assured of the sup

(1) Anesthesiology 14 376-381 July 1953

port necessary for survival. Cortisone (free alcohol) can be used intravenously if prepared according to the manufacturer's directions. A preparation is also available in which 100 mg compound F or hydrocortisone is used in 500 cc. isotonic solution of sodium chloride

The patient with evidence of hypercortisonism must be treated as is the patient with suppression of adrenal cortical function.

Reactions in Man from Infusion with Dextran occurs in 0.4% of cases, according to a survey in Scandinavian countries Both high and low reaction rates have been reported by investigators in the United States Arthur B Tarrow and Edwin J Pulaski[2] (Brooke Army Hosp., San Antonio Tex.) gave 215 patient volunteers infusions of dextran and noted the incidence and character of allergic reactions Of these subjects, 109 received Swedish macrodex, 9 dextran saline made in England and 97 dextran manufactured in the United States.

Careful inquiry into a history of allergies, a physical examination and laboratory tests preceded each infusion. Patients were given the infusions in both the anesthetized and the unanesthetized state The speed of infusion varied from 10 to 65 minutes. Most patients received 500 cc., but several were given 1,000 cc Observed symptoms and signs were headache, chills, flushing urticaria, angioneurotic edema, wheezing or choking or both, abdominal pain nausea or vomiting or both, cramps, chest pain, vasomotor rhinitis hypotension or syncope on standing, delayed pain in the joints and swelling of the extremities

The authors found that 33.9% of the patients given Swedish macrodex, 8.24% given American dextran and 44.4% given English dextran saline had reactions The incidence was lower in anesthetized than in unanesthetized patients, even though the anesthetic used was spinal and the patients were awake

Antihistamines given intravenously appeared to relieve symptoms in severe reactions but did not affect the course of the reaction. Mild, untreated reactions usually subsided

(2) Anesthesiology 14:359-366 July 1953

in 12 24 hours Preinfusion medication with antihistamines, morphine or corticotropin did not appear to limit the incidence or severity of reactions

Examination of Oxygen and Carbon Dioxide Concentrations in Adult Oxygen Tents According to R E Jahn[3] maintenance of a specified oxygen concentration within a tent requires an oxygen flow rate much greater than the patient's actual metabolic needs, usually 0 5 L/minute The excess is needed to replace oxygen lost from the tent by displacement of the tent atmosphere and by diffusion If the oxygen tent were completely sealed and the input of oxygen adjusted to replace that used by the patient's metabolism, carbon dioxide would rapidly accumulate A soda lime absorber could be used but the cost of the soda lime plus the increased attention such a tent would need does not make the arrangement feasible

Although the leakage taking place cannot be predicted it is possible to calculate (1) the volume of oxygen required to bring the tent concentration to a certain figure, (2) the amount of diffusion taking place from the tent and (3) the quantity of carbon dioxide which may be expected in the tent Jahn has verified these calculations experimentally He has found that the only reliable method of knowing the oxygen concentration inside a tent is to undertake periodic oxygen analyses

A method of operation of an adult oxygen tent is suggested by which both oxygen and carbon dioxide can be controlled

METHOD —The tent is assembled according to the maker's instructions. The oxygen flow rate is then adjusted to the highest available on the flowmeter About 300 L. oxygen is passed into the tent as quickly as possible if 50% oxygen is required, and the tent atmosphere is analyzed to see that the oxygen concentration has been reached. An approximate estimate is now made of the rate of carbon dioxide evolution by the patient, and the maximal allowable carbon dioxide concentration inside the tent is decided on. The required oxygen maintenance flow rate is calculated from the formula

$$M = \frac{100\ L\ (x - 21)}{79\ C}$$

where M is the maintenance flow rate of oxygen in liters/minute,

(3) Brit J Anaesth. 25 188 203 July 1953

L the rate of carbon dioxide evolution by the patient in liters/minute, x the oxygen concentration in per cent, and C the maximal allowable carbon dioxide concentration in per cent. The amount of leakage is arranged by trial following oxygen analyses at intervals to give the oxygen concentration required

MAINTENANCE OXYGEN FLOW RATES REQUIRED FOR GIVEN O_2 AND CO_2 CONCENTRATIONS IN ADULT OXYGEN TENTS

CO_2 Evolution by Patient L./Min	Max. CO_2 Conc. in Tent C	Flow Rate of O_2 (L./Min.) to Maintain CO_2 at Level of 2d Col. and also	
		40% O_2	50% O_2
0.2	0.5	9.6	14.7
	1.0	4.8	7.4
0.3	1.0	7.2	11.0
	2.0	3.6	5.5

In the accompanying table a few maintenance flow rates are given as examples The figures make due allowance for leakage An oxygen tent operated in this manner could be used for control experiments if it should be desired to examine critically the value of oxygen in a given treatment

Relationship of Anesthesia to Postoperative Personality Changes in Children. An investigation correlating the preparation and induction of anesthesia with personality changes in 612 children who underwent otolaryngologic operations is reported by James E Eckenhoff[4] (Philadelphia) Seventeen per cent of the children had personality alterations which might be traced to anesthesia the hospital experience or both Night cries or terrors constituted 32% of the changes temper tantrums comprised 26% fear phenomena (afraid of darkness unaccustomed odors strangers or of having face covered) constituted 23%, the remaining 19% pertained to bed wetting

The incidence of personality change was highest in the youngest children With unsatisfactory inductions of anesthesia the probability of undesirable personality change was greater in young children than if induction were smooth In children over age 8 with unsatisfactory inductions, personality alterations differed little from those of like age with satisfactory inductions.

(4) A.M.A. Am. J. Dis. Child. 86 587-591 November 1953

The percentage of personality changes was approximately the same with all induction agents A surprising finding, however, was that of 25 complaints related to bed wetting, 23 were in patients given vinyl ether Vinethene* was also the agent used in eight of the nine children from this study who had convulsions or convulsive movements during induction.

This study confirms a previous report that careful attention to the timing of the administration of preanesthetic medication could materially reduce undesirable sequelae. This medication should include a barbiturate with the belladonna drug

INDEX

B

C

M

N

O

P

U

V

INDEX TO AUTHORS

L

M